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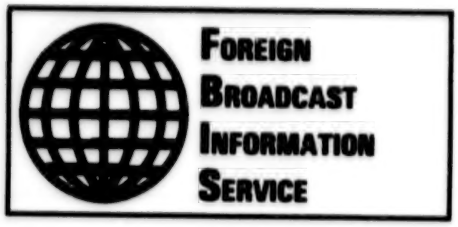

JPRS Report

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[Text]

Federative Republic of Brazil, 15 November 1989

National Congress [CN]

CPMI [Joint Congressional Investigative Commission]: Causes and Dimensions of the Technological Lag

FINAL REPORT

Chairman: Senator Mario Covas - PSDB [Brazilian Social Democracy Party]-SP [Sao Paulo]

Reporter: Deputy Irma Passoni - PT [Workers Party]-SP

NATIONAL CONGRESS [CN]

The Joint Congressional Investigative Commission, created through Petition No. 493, of 1991-CN, "is intended to investigate the causes and dimensions of the technological lag in the productive processes of Brazilian industry, as well as in the research processes and the educational and research institutions of Brazil."

COMPOSITION

Chairman: Senator Mario Covas Vice-Chairman: Deputy Cesar Bandeira Reporter: Deputy Irma Passoni

Senators:

Coutinho Jorge, PMDB [Brazilian Democratic Movement Party], Flaviano Melo, PMDB, Joao Calmon, PMDB, Mansueto de Lavor, PMDB, Raimundo Lira, PFL [Liberal Front Party], Francisco Rollemberg, PFL, Carlos Patrocinio, PFL, Mario Covas, PSDB, Beni Vera, PSDB, Levy Dias, PTB [Brazilian Labor Party], Darcy Ribeiro, PDT [Democratic Labor Party], Ney Maranhao, PRN [National Reconstruction Party], Joao Franca, PDS [Democratic Social Party], Gerson Camata, PDC [Christian Democratic Party], Eduardo Suplicy, PT

Deputies:

Arolde de Oliveria, Bloc, Gustavo Krause, Bloc, Cesar Bandeira, Bloc, Fausto Rocha, Bloc, Jose Thomaz Nono, PMDB, Marcelo Barbieri, PMDB, Nelson Proenca, PMDB, Paulo Ramos, PDT, Eduardo Mascarenhas, PDT, Marcelo Luz, PDS, Magalhaes Teixeira, PSDB, Joao Mendes, PTB, Irma Passoni, PT, Ariosto Holanda, PSB [Brazilian Socialist Party], Jarvis Gaidzinski, PL [Liberal Party]

Alternates:

Onofre Quinan, PMDB, Benedito de Figueiredo, Bloc, Ronan Tito, PMDB, Aroldo Cedraz, Bloc, Ruy Bacelar, PMDB, Gonzaga Mota, PMDB, Henrique Almeida, PFL, Roberto Valadao, PMDB, Hydekel Freitas, PFL, Edson Silva, PDT, Fernando H. Cardoso, PSDB, Telmo Kirst, PDS, Jose Eduardo, PTB, Paulo Silva, PSDB, Nelson Wedekin, PDT, Onaireves Moura, PTB, Albano Franco Tilden Santiago, PT

As Reporter for this CPMI, I wish to express my thanks to the officials who helped in the preparation of this report:

Consultants:

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* Embrapa - Brazilian Agricultural and Livestock Research Enterprise

** Unicamp - Campinas State University

SECRETARIAT OF SPECIAL AND INVESTIGATIVE COMMISSIONS

Ms. Sonia de Andrade Peixoto - Chief; Mr. Jose Augusto Panisset Santana - Secretary; Mr. Irani Ribeiro dos Santos - Aide; Mr. Luciano Candido Mariz - Aide

FEDERAL SENATE ADVISORY SERVICE FOR ADMINISTRATIVE SUPPORT

Mr. Carlos Henrique Nascimento - Legislative Analyst

THE REPORT SUMMARY

THE REPORT

1. INTRODUCTION

By virtue of the approval of Petition No. 493, of 1991-CN, a Joint Congressional Investigative Commission was created, for the purpose of investigating the causes and dimensions of the technological lag in the productive processes of Brazilian industry, as well as in the processes of generating and disseminating technology in the research centers and educational and research institutions of Brazil.

Signed by 204 Deputies and 44 Senators, the proposition was accepted by the National Congress Plenum at its session of 16 April 1991.

On 23 May, the installation meeting was held, an occasion on which Senator Mario Covas was elected chairman; Deputy Cesar Bandeira, vice chairman; and Deputy Irma Passoni, reporter.

On 28 May, the first taking of depositions took place. At that time, the methodology agreed upon for the CPMI's operation was put into effect for holding panel discussions, organized through a convocation of persons directly or indirectly linked to the national scientific and technical process. Included therein were the productive sector (for example, the automotive, electromechanical, and military ordnance industries), the universities, the organs responsible for the development policies, and the communications media specializing in the dissemination of scientific and technical information.

A total of 100 persons was queried at 22 meetings for taking depositions. Added to that number was a special meeting held to hear about the Japanese experience, as well as external meetings held in Campinas and Sao Jose dos Campos, two public hearings also held in Campinas and Sao Jose dos Campos, and the Commission's internal meetings intended to deal with methodological and administrative issues.

The last depositions were taken on 24 September 1991.

1.1 - Objectives of the CPMI

The objectives of the CPMI are stated in the Justification of the terms of the Petition that created it:

"An inquiry to investigate the causes of the technological lag today is associated with an inquiry to investigate the causes of the wealth of nations. The latter gave rise to the formulation of the Classic Economy. For Brazil, it is hoped that the Joint CPI [Congressional Investigative Commission] currently proposed will be able to identify the shortcomings limiting technological progress, so as to make it possible to establish, on a national basis, scientific and technical development goals for the short, medium, and long terms.

"The government's action in the strategic areas of science and technology and its implications in research and development policy has proven to be deeply contradictory. On the one hand, the government offers a new industrial policy without specifying the means for action. On the other, it cuts necessary funds, reduces a specific budget, dismantles excellent research and development centers, demoralizes associated public offices and their employees, and demobilizes technical training programs.

"Now, the government admits that it is investing only 0.74 percent of the GDP in science and technology; and hence, is systematically reducing the funds applied to this sector. It notes (in the specific case of the FNDCT [National Fund for Scientific and Technical Development]) that 'the 100 percent index for 1975, equivalent to $253 million, reached an index of 11 percent in 1990: in other words, only $28 million. In 1985, 4.1 percent of the budget funds was applied to science and technology; in 1991, only 1.5 percent was applied.' From that standpoint, the technological base of Brazilian industry, now lagging 15 years (as the secretary of science and technology admitted) behind the developed countries, does not prompt the assumption that

it would be capable of promoting a technological renewal, to make the industry competitive on foreign markets, and even internally, in the event of a likely opening of the Brazilian market.

"Preliminary results of research conducted by the University of Campinas entitled, 'Made in Brazil,' reveal dramatic lags in strategic sectors of Brazilian industry, according to its coordinator, Luciano Coutinho.

"Based on those records, and also considering the fact that:

"1 - the importance of scientific and technical development is unquestionable in the process of generating wealth and perfecting the Brazilian individual;

"2 - the formulation of an S&T policy is essential for the establishment of goals to finance S&T activities in research centers and enterprises;

"3 - S&T activities have a long maturity period (typically showing results within periods of 15-20 years); and hence, transcend government terms;

"4 -plans originating in the Executive Branch naturally deal with the more immediate, operational aspects in the areas for which they are intended;

"5 -the current phase of scientific and technical expertise in Brazil needs to be defined, so as to establish the base from which Brazil will develop over the next 20 years;

"6 -Brazil will not be able to attain the scientific and technical development of the countries that are S&T leaders (the U.S., Japan, Western Germany) within the next 20 years, regardless of the effort to be expended;

"7 -Brazil has resources constructed over the past 50 years, in terms of facilities and personnel which, if used coherently, could lead it to a scientific and technical level comparable to that of some developed countries;

"8 - the combined action desirable in science and technology far exceeds the available resources that will exist for that field;

"9 - the action selected for execution and its prioritization should be based on a long-term plan, clearly stipulating:

"I - the objective to be attained;

"II - the intermediary goals, making it possible to monitor and correct courses of action during its effective period;

"10 - Brazil has made scientific and technical development plans in the past, and the results of those plans should be considered in devising future plans;

"11 the National Congress has become the natural forum for preparing and discussing extensive long-term policies;

"12 - Brazil is a country with meager financial and human resources, and this situation will still continue over the long term required by this proposal (20 years);

"13 - Brazil should determine the group of areas that will be key elements for the competitiveness of its products and their development, because the available resources will not suffice to cover all fields of knowledge; this implies stimulating certain fields, and keeping others in a mere holding pattern of activity;

"14 - the Congress is the ideal environment for discussing and channelling compromise solutions, such as those involved in setting priorities for activities carried out by the country's intellectual elite;

"15 - the Brazilian State, as a leading financier of scientific and technical activities in the country, should link that activity to the solution to the nation's problems. The Congress has the power and responsibility for channeling those decisions, based on this viewpoint.

"With these considerations, so as not to thwart hope in the future of the nation, which is entitled to aspire to the development of its material base through scientific and technical progress, given the extreme importance of the issue, we demand a combined effort by both Houses of Congress to establish a joint Congressional Investigative Commission for the purposes defined above."

1.2 Methodology for operation

Based on the deliberations of the Commission's Plenum, the following methodological guidelines required for the faithful fulfillment of its objectives were established:

a) identification of the fields of knowledge and sectors of the productive system essential for the reduction of the country's scientific and technical gap;

b) preparation of a schedule for each presentation, aimed at subsequent analysis of the depositions as a whole;

c) selection of depositions covering economic sectors and key areas for relating concrete experience in those areas, with special emphasis on the inclusion of rebuttals and interruptions in the depositions at a meeting;

d) analysis of the information from the depositions, according to an established schedule, for the purpose of:

- devising a general picture of the country's situation in the various sectors;
- assessing the past experience insofar as it relates to policies and instruments used, identifying the successes and failures in the planning and execution of those policies;
- compiling a possible scenario of the country to demarcate the establishment of policies (industrial, educational, regional, and financial) and other instruments within the jurisdiction of the National Congress;

- providing the necessary means and processes to monitor the various sectors, so as to achieve the desired scenario, factoring common requirements into the sectors analyzed;
- making it possible to devise an opinion intended to assist the National Congress in its analysis of the plans and budgets originating in the Executive Branch, and also to anticipate the formulation of legislative propositions.

1.3 - Criteria for selection of deponents

An attempt was made to identify the key areas and economic sectors involved in the process, according to the following criteria:

a) present and potential economic significance;

b) potential for absorbing new technologies originating in those key areas, by each of the sectors;

c) state of the art in world technology and opportunities for marketing products;

d) the sector's multiplying effect with respect to the economy.

Using these basic criteria, the following fields of knowledge were identified as capable of being influential owing to their scientific and technical advancement:

a) biotechnology and genetic engineering;

b) informatics and communications;

c) new materials;

d) fine chemistry;

e) ecology.

Finally, since they are recipients of the technology generated, a priority hearing was set for the following economic sectors, as dynamizers of scientific and technical development processes:

a) basic industry;

b) aerospace, naval, and military industry;

c) petrochemical industry;

d) agriculture;

e) electro-electronic complex;

f) services sector.

1.4 - Methodology for meetings

Based on the preliminary investigations that prompted the convocation of the CPMI, a minimal, but flexible schedule was established, to be followed by the deponents, so as to guide the preparation of this Report and of the Opinion as well.

It should be stressed that, after the series of depositions submitted at each session, the floor was given to the Commission's members, in order of their registration, so that they might query the deponents on points that their depositions did not make clear. That schedule indicated the following:

a) current phase of the sector (relevant S&T aspects for outlining a historical perspective extending to the present configuration)

Based on that perspective, the combined information requested should consist of:

1 - economic indicators and potential of the sector (for example, percentage of GDP, labor profile, among others);

2 - government policies relating to the sector, such as the industrial policy, the incentives and subsidies policy, the technical training policy, the financial policy, the educational policy, and the regional development policy;

3 - results produced by the sector, compared with the previously proposed plan;

4 - instruments for disseminating technology.

b) Long-term perspective for the sector (10 years)

This part of the deposition was supposed to provide feasible and desirable proposals for the sector, with emphasis on the relevant S&T aspects. The characterization of the desired scenario would include:

1 - configuration of the sector's economic potential in the light of the indicators adopted;

2 - qualitative and quantitative description of human resources supporting the scenario;

3 - the desired configuration of products and technologies;

4 - supplying of the internal market and the inclusion of products on the external market.

c) Proposal for making the desired scenario viable

This part of the deposition was supposed to indicate the group of measures and policies required to direct the sector, starting at the current phase, depicted in part a).

For the scenario described in part b), the following points would be considered:

1 - planning requirements for the sector and impact on other sectors;

2 - necessary policies and instruments (industrial, agricultural, educational, and regional policy);

3 - necessity for HR [human resources] and training process;

4 - necessity for financing resources and profiles;

5 - dependent relationship with foreign countries in the appropriation of technologies, processes, and products;

6 - criteria for monitoring the process and intermediate goals.

This schedule was aimed at making it possible to consolidate the depositions through an integrated view of the

various sectors, even though they might relate to quite different activities and fields of knowledge. However, it was made clear to the deponents that their remarks should not be limited to the stipulations in the schedule.

1.5 Timetable for meetings

The meetings were held according to the following timetable, agenda, and depositions, bearing in mind the premises that dictated the terms of the Commission's convocation.

Date: 25-5-91 - First Meeting

Induction

Date: 28-5-91 - Second Meeting

Report on the Technological Status of Brazilian Industry and the Establishment of an Innovation System in Brazil

Deponents: Dr. Luciano Coutinho, President of the Campinas Economic Foundation - CCAMP

Dr. Wilson Suzigan, Advisor of the Campinas Economic Foundation - CCAMP

Dr. Joao Paulo Dos Reis Veloso, President of the Brazilian Capital Market Institute - IBMEC

Dr. Jorge Gerdau Johannpeter, President of the Gerdau Group

Date: 29-5-91 - Third Meeting

Reassessment of the Work Schedule

Date: 4-6-91 - Fourth Meeting

The Dismantling of the Electronics Complex in Brazil - Segments of the Hardware, Software, and Electronics Field Involved - Diagnoses and Proposals

Deponents: Prof. Jose Rubens Doria Porto, President of the Unicamp Institute of Economics

Dr. Victor Blatt, Superintendent-Director of SID/ Microelectronics

Dr. Nelson Peixoto Freire, Technology Director of the Brazilian Association of National Electro-Electronic Industries - Abinee

Date: 11-6-91 - Fifth Meeting

The Status of Scientific Resarch and Training of Human Resources for Scientific and Technical Development

Deponents: Prof. Enio Candotti, President of the Brazilian Society for Scientific Development - SBPC

Dr. Manoel Malheiros Tourinho, Administrative Director of the Brazilian Agriculture and Livestock Research Enterprise - Embrapa

Prof. Moises Nussenzweig, Federal University of Rio de Janeiro - UFRJ

Prof. Fernando Zlavislask, Director of the Institute of Physics at UFRS [Federal University of Rio Grande do Sul]

Prof. Tania Cavalhal, President of the Association of Post-Graduate and Research Programs in Language and Literature

Prof. Roque Laraia, President of the Brazilian Association of Anthropology and Professor at the University of Brasilia - UnB

Date: 17-6-91 - Sixth Meeting

Science and Technology in the Naval and Military Industry

Deponents: Fleet Admiral Mario Cesar Flores, State Minister of the Navy

Dr. Mario Bernardini - Vice President of Abimaq [Brazilian Association of Machine Industries]

Date: 18-6-91 - Seventh Meeting

Science and Technology in the Aerospace Complex

Deponents: Dr. Jose Sousa Santos, Financial Director of the Brazilian Aeronautics Company - Embraer

Dr. Marco Antonio Raupp - ex-General Director of the National Institute of Space Research - INPE

Air Brigadier Major Sergio Xavier Ferolla, Director of the Aerospace Technical Center - CTA

Dr. Eduardo Antonio Prado Tude - President of the Union of Federal Public Servants of Sao Paulo

Date: 24-6-91 - Eighth Meeting

Impacts of Liberalization on Computer Science Policy

Deponents: Dr. Fuad Gattaz Sobrinho, Executive Director of the Brazilian Agriculture and Livestock Research Enterprise - Embrapa

Dr. Paulo Roberto de Mattos - Director of Manufacture and Technology of IBM/Brazil

Dr. Lourival do Carmo Monaco, President of the Funding Authority for Studies and Projects - Finep

Dr. Claudio Mammana, Assistant Secretary of Science, Technology, and Economic Development of the State of Sao Paulo

Dr. Paulo Feldman, President of the Association of Computer Science Users - Sucesu

Date: 25-6-91 - Ninth Meeting

Science and Technology in the Automotive Complex

Deponents: Dr. Joao Augusto Conrado do Amaral Gurgel, President-Director of Gurgel

Dr. Jacy Mendonca, President of the National Association of Automotive Vehicle Manufacturers - Anfavea

Prof. Jose Roberto Ferro, Professor in the Production Engineering Department of the Federal University of Sao Carlos - SP

Dr. Jose Mindlin, President of Light Metal

Dr. Carlos Rocha, President of the Brazilian Association of Components and Peripherals Industries - Abicomp

Date: 27-6-91 - Tenth Meeting

Work Meeting - Reassessment of the Schedule

Date: 5-8-91 - Eleventh Meeting

National Dependence in the Pharmaceuticals and Fine Chemistry Sector and Policies on Trademarks and Patents

Deponents: Dr. Dante Alario Junior, President of Alanac

Dr. Kurt Politzer, Chairman of the Administrative Board of Chemical Industries of Taubate

Date: 6-8-91 - Twelfth Meeting

Science and Technology in the Agrofood Complex and Policies on Trademarks and Patents

Deponents: Dr. Murilo Xavier Flores, President of the Brazilian Agriculture and Livestock Research Enterprise - Embrapa

Dr. Ney Bittencourt Araujo, President of Agroceres

Prof. Luiz Carlos Pinheiro Machado, Professor at the Federal University of Santa Catarina - UFSC, and ex-President of Embrapa

Dr. Tania Munhoz, President of the Brazilian Institute of Environment and Renewable Natural Resources - Ibama

Dr. Guilherme Emrich, President-Director of Biobras

Dr. Nelson Brasil de Oliveira, President of Abifina

Date: 13-8-91 - Thirteenth Meeting

Technological Dependence and Legislation to Protect Industrial Property

Deponents: Dr. Roberto Braz Matos Macedo, Special Secretary of Economic Policy

Federal Deputy Luiz Henrique, ex-State Minister of Science and Technology

Dr. Luiz Paulo Veloso Lucas, Director of the Industry and Commerce Department of the National Secretariat of Economy

Dr. Jose Diniz de Souza, President of Eletrometal

Prof. Ubirajara Quaranta Cabral, Professor at the Federal University of Rio de Janeiro - UFRJ/COPPE [Coordination Board of Post-Graduate Engineering Programs]

Dr. Mario Arruda - Superintndent of the Institute for Industrial Development Studies

Date: 15-8-91 - Fourteenth Meeting

Scientific and Technological Dependence and the National Policies

Deponents: Prof. Jose Goldemberg, Secretary of Science and Technology

Dr. Renato Bayma Archer da Silva, ex-State Minister of Science and Technology

Prof. Jose Walter Bautista Vidal, Professor in the Department of Science and Accounting Administration of UnB

Dr. Paulo Paixao, President of Diesse [Interunion Department for Statistics and Socioeconomic Studies]

Prof. Nelson Maculan Filho, Rector of the Federal University of Rio de Janeiro - UFRJ

Date: 19-8-91 - Fifteenth Meeting

Process of Disseminating Science and Technology Through the Media

Deponents: Journalist Fabiola de Oliveira, President of the Brazilian Association of Scientific Journalism

Prof. Luiz Martins da Silva, Professor on the Communications Faculty of UnB

Journalist Murilo Antonio de Carvalho, Bandeirantes Network

Journalist Heloisa Magalhaes, GAZETA MERCANTIL

Journalist Sergio Brandao, Video Science Productions, Ltd.

Journalist Fernando E. Correa, Vice President of the Southern Brazil Communications Network

Date: 20-8-91 - 16th Meeting

Science and Technology and Regional Policies

Deponents: Federal Deputy Ariosto Holanda, ex-Secretary of Industry and Commerce of Ceara State

Dr. Irundy Edelwiss, ex-Director of the Research and Development Center - Ceped

Prof. Laercio Nunes e Nunes, Federal University of Pelotas - UFPEL

Dr. Aloisio Barbosa, Executive Director of the Technological Analysis, Research, and Innovation Center - Fucapi

Dr. Roberto Oliveira Aguiar, President of the S&T Support Foundation of Pernambuco

Date: 26-8-91 - 17th Meeting

Science and Technology and Telecommunications

Deponents: Dr. Leoncio Vieira Rezende Neto, Superintendent-Director of CPqD/Telebras [R&D Center/Brazilian Telecommunications, Inc.]

Dr. Walter Eduardo Teixeira Machado, President-Director of ABC XTAL Microelectronics

Dr. Jose Mauro Leal Costa, Director of Technology of the ABC ALGAR Group

Dr. Mauro Porto, National Secretariat of Communications

Prof. Milton Ferreira, Professor at the Federal University of Sao Carlos

Dr. Allen Habert, Director of the Engineers Union of Sao Paulo State

Date: 27-8-91 - 18th Meeting

Work Meeting

Date: 2-9-91 - 19th Meeting

Science and Technology in Agroindustry

Deponents: Dr. Antonio Cabrera, State Minister of Agriculture and Agrarian Reform

Dr. Jaime Penna Shutz, Superintendent-Director of Metallurgy, Dedini

Prof. Maurilio Alves Moreira, Chairman of the Research Council at the Federal University of Vicosa

Dr. Paulo Brasil, Secretary of Irrigation Planning

Dr. Otamar de Carvalho, Director of the Vale do Sao Francisco Development Company - Codevasf

Dr. Abraham Kazinsky, President of Cofap

Date: 3-9-91 - 20th Meeting

Educational Policies, Scientific Education, and Training of Human Resources for Science and Technology

Deponents: Prof. Octavio Elisio, Secretary of Science and Technology of Minas Gerais State

Prof. Lauro Pio de Miranda, Technical Director of Senai [National Service for Industrial Apprenticeship]

Date: 9-9-91 - 21st Meeting

Technological Innovations in the Health Sector

Deponents: Dr. Aloysio Campos da Paz Junior, Director of the Sarah Kubitschek Rehabilitation Center

Dr. Hermann Schatzmayr, President of the Oswaldo Cruz Foundation -Fiocruz

Dr. Adib Jatene, Heart Institute - Incor/SP [Sao Paulo]

Dr. Uriel Vilas Boas, Chairman of the Interunion Department of Occupational Health and Environmental Studies and Research - Diesat

Prof. Fernando Infantose, Coordinator of Post-Graduate Engineering Programs - COPPE-UFRJ

Date: 10-9-91 - 22nd Meeting

The Success of the Paper and Cellulose Sector

Deponents: Dr. Armando da Silva Figueira, President-Director of Aracruz Cellulose

Dr. Jose Carlos Pisani, Vice President of the Paper and Cellulose Manufacturers Association

Dr. Hans Lauermann, Executive Director of Voith Machines and Equipment, Inc.

Dr. Raul Speltz, Klabin Industries

Date: 16-9-91 - 23rd Meeting

Science and Technology in the Energy Complex

Deponents: Dr. Aureliano Chaves, ex-Minister of Mines and Energy

Dr. Jorge Altenfelder, Plants Projects Consultant

Dr. Frederico Magalhaes Gomes- Special Advisor for Science and Technology at Eletrobras [Brazilian Electric Power Company, Inc.]

Date: 17-9-91 - 24th Meeting

The Scrapping of Industries: Causes and Consequences

Deponents: Dr. Venilton Tadini, Director of BNDES [National Bank for Economic and Social Development]

Dr. Jose de Miranda Diaz, President of Elebra [Brazilian Electronics]

Dr. Plinio Assmann, ex-President of Cosipa [Sao Paulo Iron and Steel Company]

Dr. Deusdedit Carvalho de Moraes, President of the Brazilian Association of Scientific-Technical Instrumentation and Systems -Insiste

Dr. Rolf Hundertmark- Consultant at Insiste

Date: 23-9-91 - 25th Meeting

Absorption and Development in Science and Technology

Deponents: Dr. Lourival do Carmo Monaco, President of the Funding Authority for Studies and Projects - Finep

Prof. Marco Luiz dos Mares Guia, Chairman of the National Council for Scientific and Technical Development - CNPq

Prof. Lynaldo Cavalcanti de Albuquerque, ex-Chairman of the CNPq

Prof. Eunice Ribeiro Durhan, General Director To Coordinate Improvement of Advanced Professional Training - Capes/MEC [Ministry of Education and Culture]

Date: 24-9-91 - 26th Meeting

Science and Technology in the Mineral Complex

Deponents: Dr. Roberto Villas Boas, General Director of the Center for Mineral Technology - Cetem

Dr. Wilson Nelio Brummer, President of the Vale do Rio Doce Company

Dr. Elmer Prata Salomao, General Director of the National Department of Mineral Production - DNPM

Dr. Celso Dal'Re Carneiro, Coordinator of the Geology and Mineral Resources Division of the IPT/SCT/SP [Institute of Technological Research/Secretariat of Science and Technology/Sao Paulo]

Date: 1-10-91 - 27th Meeting (Special)

Assessment of the National Strategies in Science and Technology

Expositor: Dr. Jiro Maruhashi, Cultural and Press Attache at the Embassy of Japan

2. HISTORICAL OUTLINE OF THE NATIONAL SCIENTIFIC AND TECHNICAL DEVELOPMENT

The institutional history of Brazil's scientific and technical development dates back to 1949, when the president of the republic, General Eurico Gaspar Dutra, sent a message to the National Congress, on 12 May, proposing the creation of the National Research Council. His purpose was to rank the country ahead of other nations that had experienced significant economic progress during the post-war period, especially the United States, Great Britain, Canada, and France.

In fact, when Brazilian history is examined, one observes that the development of its industry gained prominence starting in the 1930's, with the recognition of the need to establish an effective industrial policy aimed at economic progress. During that period, and until 1950, an effort was made to emerge from the preponderantly agrarian model, creating the basic conditions for industrialization.

In 1942, the establishment of the National Iron and Steel Company in Volta Redonda made it possible to lend the first shape to that idea, by initiating an increasing process of organizing the productive capacity. This was based on the processing of available raw material that had nevertheless been little used internally, as in the case of iron ore, owing to the lack of a suitable infrastructure for that purpose.

The establishment of the Vale do Rio Doce Company, Petrobras, and the National Economic Development Bank dates back to that phase.

A few research institutions also appeared (the National Institute of Technology, the Mineral Production Laboratory, and the Institute of Technological Research, for example). Several notable schools were founded as well (the Ouro Preto School of Mines, the USP's Polytechnical School, and the University of Brazil's National School of Engineering).

The creation of the National Research Council in 1951, as a result of the direct interest of its first president, Admiral Alvaro Alberto, was based on the need for an in-depth study of nuclear energy. Thus, for the first time, the government perceived the importance to the country of having an institution aimed essentially at the systematic promotion of aid to research and training of scientists.

In 1952, the Council for Advanced Professional Training (Capes), linked to the Ministry of Education and Culture, was founded. It became associated with the effort of the CNPq, at that time in connection with the training of university faculty.

The Aeronautical Technology Institute [ITA], founded during that period, became an educational establishment par excellence in the entire country.

During the early 1960's, the automotive and shipbuilding industries were established, as well as a few others for the production of capital goods. This did not mean that the universities and research institutions played a leading role in the industrialization process. Prominent, however, was the founding of the COPPE-UFRJ, owing to the new impetus offered to post-graduate level education in the engineering field.

In 1964, the National Economic Development Bank set up a scientific-technical development fund, making possible an undeniable impetus for the promotion and financing of research and post-graduate work. This occurred, specifically, in the fields of engineering, physics, chemistry, and agronomy, at first, followed by mathematics and geology. This fund was responsible for the financing of research institutions and centers for many years.

The Strategic Development Plan for 1968-70, approved in 1968, observed scientific and technical research included for the first time in the nation's history as a priority area in government policies.

As a result, in 1969 the National Fund for Scientific and Technical Development (FNDCT), linked with the Presidency of the Republic, was founded, replacing the BNDE's Funtec [Scientific-Technical Development Fund]. It has maintained as a major concern the goal of providing the country with stable mechanisms aimed at ensuring support for research and the training of highly qualified personnel.

During the 1970's, priority was given to the improvement of the infrastructure to support industrialization, involving the energy, transportation, and educational sectors, as well as laboratory modernization and diversification of the petrochemical industry.

Besides the creation of the Funding Authority for Studies and Projects (Finep), the National Research Council was converted into a National Scientific and Technical Development Council. It was no longer linked directly to the Presidency of the Republic, but rather became an advisory organ of the Planning Secretariat. It also ceased to be a self-sufficient unit, becoming a foundation, which would ensure it greater autonomy.

A modern federal research network was created (Cenpes [Research and Development Center], Cepel, IEN [Nuclear Engineering Institute], Cetem [Mineral Technology Center], Embrapa [Brazilian Agriculture and Livestock Research Enterprise]), as well as a state system (Nutec, Ceped, IPT [Institute of Technological Research], Ipen [Institute for Energy and Nuclear Research], Cientec, Tecpar, Itep, and others). Moreover new university engineering courses were created.

It should be stressed that the first Basic Plan for Scientific and Technological Development (I PBDCT) was devised during that period, and was in effect from 1973 to 1974. Its initial goal was to promote a heightening of government efforts, particularly for financial resources by way of the National Scientific and Technical Development Fund (FNDCT), intended to reinforce the research infrastructure.

The PBDCT's that followed were aimed at reinforcing the technological capacity of national enterprise, for the purpose of consolidating and making practicable an S&T policy directed toward greater technological autonomy for the country. Its main goal was coordination among the various organs of the National Scientific and Technological Development System.

Insofar as private enterprise is concerned, also during the 1970's, large engineering companies and consulting offices were established.

The scientific and technical infrastructure then established and installed, especially to provide facilities and training for human resources, made it possible to respond to the productive sector's research needs.

Among other institutions, the Telebras Research and Development Center, the National Institute for Space Research, and the Technological Center for Informatics were created.

During the next decade, the economy was typified by a search for new markets and commercial partnerships, for the purpose of recovering the competitiveness of national products.

Thereafter, the funds allocated for scientific and technical development became scarce, the main reflection of which occurred in the deterioration of the university educational system, research laboratories, and salaries of technical personnel. The number of national engineering and consulting companies became markedly reduced.

On the other hand, to ensure the continuity of scientific and technical development, then stricken by a shortage of funds, mechanisms to support the activity were created. An example of this was the Scientific and Technological Support Program of the newly created Ministry of Science and Technology. It became the first major national experiment associating government action in that area with the market, especially with respect to new materials, biotechnology, fine chemistry, precision mechanics, and informatics.

The Human Resources for Strategic Areas Program, simultaneous with these initiatives, was intended to combine leading edge research with the necessary improvement of technical personnel.

At the present time, over 100 scientific and technical development agencies have been established in the country, represented by institutions for education, research, and development. They include agroindustry, petrochemistry, metal-working, mining, metallurgy, iron and steel, the paper and cellulose industry, the sugar and alcohol industry, telecommunications, electro-electronics, transportation, the fertilizer industry, biotechnology, chemistry, computers, the food and textile sectors, and others.

Funds totaling approximately $1.5-$2 billion have been invested in instruments and facilities, at an operational cost of nearly $400 to $500 million per year.

All this was to be responsible for the generation of products and services worth apparoximately $100 billion during the past 15 years.

Added to this current infrastructure is that created at the end of the 1980's, and still available, in the fields of engineering and consulting, with annual billing totaling approximately $300-$400 million.

However, at present, because of an obviously recessive situation, as may be observed in the specific chapters relating to the Report and Opinion, particularly that pertaining to support for public and private investment, a drastic reduction has occurred in that capacity.

For the near future, the Multiannual Plan covering 1991-95 calls for a rather unsatisfactory supply of investments needed to support and modernize the federal research centers and institutions. This may be noted in the opinion offered by the reporter from this CPMI on the S&T segment comprising that portion of the budget. In particular, it should be realized that the uncertainty surrounding 70 percent of the funds dramatizes the picture further still.

Insofar as private investment is concerned, the financing allocated stands between 0.1 and 5 percent of the billing, depending on the field of activity and the dynamics of the market.

We should cite the exception, still with regard to entrepreneurial participation in the S&T development process, of light metals, which have an installed research center in full operation in the United States, thanks to funds from Finep.

The newly launched Brazilian Program for Quality and Productivity and the Industrial Competitiveness Program were aimed at enabling national production to reach a higher level, making its competitiveness on the world market possible. This is to be done through three basic types of action: a gradual reduction in protectionism for the national industry; the creation of credit lines needed to restructure industry for purposes of technological training and, consequently, competitiveness; and the encouragement of specialized production, also for the purpose of attracting specific markets.

3. Areas Analyzed

3.1 Electronics complex

After nearly 15 years of a National Informatics Policy (PNI) which, in fact, began in 1976, when the Capre [Electronic Data Processing Coordination Committee] stipulated that the market segment for mini- and microcomputers and their peripherals would be reserved for products manufactured with national technology, Brazil succeeded in establishing a national informatics industry. It is, simply, the sixth ranking such industry in the world (Deputy Luiz Henrique, 13-8-91) (*) and the only one in the undeveloped world (Paulo Feldman, 24-6-91).

When the Commission analyzed the "informatics" situation, it decided that the most suitable policy would be to treat the electronics complex as a whole, because all "investigations, all measurements point to a configuration in which the pole irradiating economic dynamism in the world's leading nations will be the electronics complex, and no longer the automotive complex" (J.R. Doria Porto, 4-6-91). And that economic dynamism of the electronics complex is not being depleted. "We are, in fact, at just the beginning of an extremely long period" endowed with a quality lacked by other innovative poles of dynamism, namely, "the capacity to create new solutions, to identify new applications, seeking different solutions to old problems; which will only cause that dynamism to grow" (J.R. Doria Porto, 4-6-91).

The electronics complex includes (J.R. Doria Porto, 4-6-91): I - The informatics industry;
II - The telecommunications industry;
III - The electronics industry starting up;
IV - The electronic consumer goods industry;
V - The microelectronics industry;
VI - An interrelated industry combining mechanics and electronics, also called mechatronics.

One of the criticisms of the National Informatics Policy lay in the interpretation of what the electronics complex is is supposed to be: it did not provide for the complex as a whole. The telecommunications industry had a diverse policy, dictated by the then Ministry of Communications. The same thing held true of the consumer goods or entertainment industries, whose policy was, basically, that of the Manaus Free Trade Zone (J.R. Doria Porto, 4-6-91).

(*) The references given relate to depositions to the CPMI and are indicated in summarized form. They consist of stenographic notes from the meetings held, and only the deponent's name and the date are cited, for reasons of practicality.

This diversity of policies for the various sectors of the electronics complex has prevented the country from developing an electronic components industry for all of them that would benefit from the economy of scale. For example, national microelectronics did not evolve as it could have evolved if supplied by all those sectors. And the national industries were unable to make use of the large volume of sales of electronic consumer goods (radios, television sets, video-cassettes, etc.) to boost their investments and growth.

With that introduction given, it is possible to depict the current of the electronics complex in Brazil resulting from an analysis of the depositions given. The best method of doing so may perhaps be to identify, and comment on the errors and successes of the national informatics policy and its laws.

The National Informatics Policy has both successes and errors, which were debated in depth in the CPMI by various deponents, at several meetings, as summarized in the following.

It is undeniable that the PNI had negative features. One of them has already been cited: The country should have had a national policy for the electronics complex so that it could benefit from the economy of scale resulting from it, and not merely a policy for informatics.

Moreover, the PNI was not updated when, for example, there should have been an assessment of the feasibility of a market reserve for standardized microcomputers which, because their technology was completely opened up by the manufacturers, ended up becoming "commodities." Much of the resistance to the PNI resulted from the sheer impossibility of importing standardized microcomputers, which were being produced abroad, in Taiwan, for example, in enormous quantities, with a resultant cost reduction.

Another error was to have created a protection without a commitment from the national industry. Importing was being physically barred, but no obligation was required to engage in development that would have allowed for increasing proximity to the world market in terms of price and quality. Some companies did this, but others simply became wealthy, without offering the nation anything in return (Paulo Feldman, 24-6-91).

It also gave the identical treatment (lending it the same protection) to technology-intensive equipment, such as the mini- and supermini-computers and the standardized microcomputers which, as we have seen, became "commodities" (Victor Blatt, 4-6-91).

The PNI is usually criticized for not having introduced the latest generation products into the country. Initially, it should be noted that this did not occur in informatics alone. It happened in virtually the entire industry. It could be said in informatics' favor that the technological gap was nearly eight years at the time of the launching of the 8-bit computer, when the Informatics Law first went into effect, and amounted to only a few months by the end of 1990, with the launching of 32-bit computers (Fuad G. Sobrinho, 24-6-91).

It is also claimed that the Informatics Law prevented the informatization of Brazilian society. It so happens that, before informatizing, it is necessary to train human resources. It would do no good to give a computer to every Brazilian. The vast majority would not know how to use it (Deputy Ariosto Holanda, 24-6-91).

It is also said that the Informatics Law made the Brazilian product expensive, when compared with that on the international market. However, this is not limited to computers. There are countless examples, such as pliers, 20-inch stereo television sets, color TV's, cotton shirts, etc., which cost over twice as much in Brazil as in the United States (Fuad G. Sobrinho, 24-6-91). The fact is that Brazil is an expensive country as a whole. The solution to that problem, Brazil's inclusion in terms of international competition, must be achieved structurally, without making the market reserve the scapegoat for Brazil's backwardness (J.R. Doria Porto, 4-6-91). In the first world, all production engineering is compressed, through the replacement of labor with capital goods, because labor is expensive and capital is plentiful. Brazil's problem is the opposite: a large unskilled labor supply and meager capital. This is the challenge that must be surmounted by the country's production engineering (Fuad G. Sobrinho, 24-6-91). And creating a national informatics directed toward our country's real situation is a powerful instrument for this. It must also be realized that "automation does not necessarily lead to improved quality, nor does it always bring cost reduction" (Lourival C. Monaco, 24-6-91). The deregulation advocated in the present government's economic policy "mortally wounds Brazil's capacity to generate solutions for Brazil" (Fuad G. Sobrinho, 24-6-91). "The notion that the deregulation of imports will solve our problems is completely mistaken. It would be fitting if there were industrial sectors containing companies whose production was being stifled by a lack of components. But, unfortunately, the sectors stifled are undergoing this for lack of a market; and that situation will worsen dramatically with the deregulation of imports" (Paulo Feldman,

24-6-91). The reason is that, "at the time that our market disappears, our border will be open for the imported product" (Nelson P. Freire, 4-6-91).

One of the most important consequences of the National Informatics Policy was to enable the country to develop a critical mass of nearly 70,000 qualified professionals (Deputy Nelson Proenca, 4-9-91; Deputy Luiz Henrique, 13-8-91; and Fuad G. Sobrinho, 24-6-91). However, owing to the abrupt change in the National Informatics Policy, they run the risk of unemployment, or of becoming small-scale dealers or vendors for the multinationals, as our engineers were before 1976.

Another consequence of the PNI was that, in 1989, on the Latin American level, the leading informatics producing center was in Sao Paulo; the second, in Rio de Janeiro; and the third, in Rio Grande do Sul. The fourth was comprised of the other Brazilian states, the fifth was in Mexico, and the sixth was in Argentina. During that period, Brazil had 20 times more human resources in informatics than Mexico did (Claudio Mammana, 24-6-91). The informatics market in Brazil accounts for nearly two percent of the GDP: A rate comparable to that of the developed countries. The other Latin American nations have rates close to 0.5 percent of the GDP. In those countries, a policy of openness to imports has been practiced, and they could not obtain the foreign exchange required for purchasing abroad the informatics equipment that was not manufactured locally either. The users in those Latin American countries do not complain of problems with product quality or prices; they complain about not having products (Paulo Feldman, 24-6-91).

Finally, it should be noted that the informatization of the Brazilian banking system is one of the best in the world, and fully geared to our requirements (Fuad G. Sobrinho, 24-6-91; Paulo Feldman, 24-6-91; and Deputy Luiz Henrique, 13-8-91). For example, distributed processing was introduced in view of our difficulty in telecommunications; because over 70 percent of the operations conducted in a banking agency concern only the agency itself. With distributed processing, using a network of mini- or microcomputers, the necessity for consulting the mainframe computer for each operation is avoided. Thus, a Brazilian technology geared to our conditions was created.

Insofar as the policy for the Manaus Free Trade Zone, which is basically the producer of electronic consumer goods for Brazil, is concerned, we should point out that its original goals for employment in the region, export, and value added applied to local raw materials, were never attained. What it ended up having was an enormous increase in imports, and very few exports, without any promotion of technological development. As a rather simplified example, it engages in the assembly of kits (J.R. Doria Porto, 4-6-91). Since "it is known that importing a kit of any kind is more expensive than importing a ready-made product" (Victor Blatt, 4-6-91), inasmuch as the costs of organizing, packing, transporting, etc., the kit's parts exceed those of the ready-made product, we have identified a fundamental problem for the current system in the Manaus Free Trade Zone. In fact, it is surviving at the cost of extremely high subsidies. In 1991, they should total $2 billion (J.R. Doria Porto, 4-6-91). The prices of products in the Free Trade Zone, basically for the internal market, are not competitive on the international market (Fuad G. Sobrinho, 24-6-91). Furthermore, the Free Trade Zone hardly generated a demand for well-trained human resources, or raised the level of centers for training human resources in the Amazon Region (Fuad G. Sobrinho, 24-6-91).

No one wants to simply order the end of the Manaus Free Trade Zone, even if only because it is a reality. However, the model should undergo adjustments, with a search for new solutions that will take into account the vested interests based on government policy (J.R. Doria Porto, 4-6-91; and Victor Blatt, 4-6-91). What is required is that the Manaus Free Trade Zone start concerning itself with the training of human resources, with value added for local raw materials, and with the development of technology. The Manaus Free Trade Zone must stop having a stagnant policy, dissociated from the national policy for the electronics complex.

Since the Free Trade Zone is one of the supports for the electronics complex, the one providing for electronic consumer goods, there will be no development of this complex in the country unless these policies are integrated. In other words, the electronic goods industry is a powerful booster for the development of microelectronics, informatics, and the telecommunications industry. If the country wants to develop its electronics complex, and this is a pressing requirement, it must integrate the policy on the Manaus Free Trade Zone with its national policy for the electronics complex.

One of the informatics fields in which Brazil is equipped to compete with other countries is software development. Several factors must be considered in this regard. First, the 1987 Law on Software was very late in coming, arriving when a "piracy" culture had already been established on the market. Another factor is that, with all the freedom granted, there was no multinational industry making Brazil a software producing center (Fuad G. Sobrinho, 24-6-91). And this was the case when many thought that Brazil was gifted, as a result of its culture, and hence, especially qualified or outstanding for software production. Thus, because of this special quality of the Brazilian, and the fact that a software industry requires little investment and can bring large returns, it should be given an incentive in the country. This is said discounting the fact that other countries market certain types of software as sensitive technologies, and there is not even any other option there: it must be developed internally (Fuad G. Sobrinho, 24-6-91).

As for microelectronics, its development should be considered a fundamental concern for the country. It should be regarded as infrastructure, based on its capacity for irradiation to the rest of the electronics complex. This holds true in the rest of the world, where it is enormously subsidized. This being the case, to claim that there will be no incentive from the government for a specific national policy on microelectronics is tantamount to saying that Brazil will not have a microelectronics industry (Victor Blatt, 4-6-91).

3.2 - Naval, aeronautics, and aerospace complexes

3.2.1 - Naval complex

The work meetings at which debates were held and information was collected on these sectors took place on 17 and 18 June 1991. Depositions were given by: Fleet Admiral Mario Cesar Flores, Minister of Navy; Mario Bernardini, vice president of Abimaq; Jose de Souza Santos, financial director of Embraer; Air Brigadier Sergio Xavier Ferolla, director of the Aerospace Technical Center; Marco Antonio Raupp, ex-general director of the National Institute of Space Research - INPE; and Eduardo Antonio Prado Tude, president of the Federal Public Servants Union in the Science and Technology Area. Failing to appear, according to a mesage sent to the Chairman of the Commission, were General Joubert de Oliveira Brizida, Informatics Director for the Ministry of Army; Air Lieutenant Brigadier Ivan Moacir Frota, Director of the Research and Development Department (Deped) of the Ministry of Aeronautics; and Antonio Carlos Porto Goncalves, professor at the Getulio Vargas Foundation's Brazilian Institute of Economics.

During 1990-91, the Navy allocated approximately $100 million in funds for science and technology, in the fields of development incorporation of technology, technology expertise, industrial development, standardization, and regulation. That investment represented nearly 3.5 percent of the Navy's total budget, and 0.05 percent of the general budget of the Union. Next year, the planned investment is 7 percent from the same source of funds. This percentage could be larger if the spending on personnel (instructors, engineers, and civilian and military technicians) involved in science and technology is computed.

The Navy has S&T activity in six centers and/or directorates: the Naval Systems Analysis Center, the Naval Research Institute, the Directorate of Armament and Communications, the Directorate of Naval Engineering, the Directorate of Hydrography and Navigation, and the Institute of Marine Studies and Special Projects Coordination - Copesp. The latter is responsible for the nuclear program in which the Navy participates.

The Navy engages in science and technology activities integrated into the National System for Scientific and Technological Development, created in 1980. It uses funds from its own budget and those originating in the Strategic Affairs Secretariat - SAE, the CNPq, and the Finep. The Finep funds are very small compared with the total.

The Navy maintains a close connection with industries, aimed at specific technological development, either through contracts for the filling of orders, or in association with the Research Institute, and even with the Copesp. This type of cooperation has achieved success. The products resulting from this work fully meet the technical requirements, even including the devising of parts required in the multiple design and manufacturing stages, and many of them have enormous civilian and commercial applications. This is a process bolstering industry with a strong technological component.

As for educational policy, many accords and agreements have provided a relationship with the university structure, aimed at technological expertise for personnel. It also has the goal of fostering research at certain top-flight centers, such as the Rio de Janeiro Federal University, Rio de Janeiro State Federal University, Sao Paulo University, PUC [Pontifical Catholic University]-Rio and, in the future, Unicamp [Campinas State University].

The Navy is concerned with training and qualifying its civilian and military personnel, with an intensive program, insofar as is possible, for training both in the country and abroad, in fields of technology. The latter include metallurgy, mechanics, electricity, and electronics with a high degree of quality and structural control. The interaction with civilian entities is constant. Technological expertise is being sought persistently both in Brazilian universities and those established abroad, to supplement the scientific and technical qualifications of civilian and military personnel.

The policies governing the sector have been bringing results, primarily through the setting of objectives and clearcut, explicit goals; and also with stringent application of the meager funds available for science and technology.

The following projects, stemming from those policies, are noteworthy:

a) Structures - the design and construction of the Niteroi class frigates represented a major technological step; followed by the design of the Inhauma class corvettes and the hospital ships; now added to this is the manufacture of German-designed conventional submarines;

b) Nuclear propulsion - besides lending the country expertise in that sector, it has provided development in the field of special materials and of nuclear fuel itself, as well as special steels, with an enormous participation by private industry, such as Eletrometal of Campinas; in addition to the manufacture and development of carbon, zirconium, and other fibers. This entire technological progress is needed by the country, whether or not a nuclear-propelled submarine ever exists.

c) Informatics - initiator of the establishment of the informatics industry in Brazil, because of the need to back projects in the field of automated command and control systems, and in the hardware and software areas; it is now more concerned with artificial intelligence.

d) Communications (sonar and radar) - some of these projects had to undergo delays or even abandonment, because of an absolute lack of financial resources, compounded by the lack of an economy of scale in both the civilian and the military area.

The Navy is pursuing, and has as one of its goals, even following strategies and results from more advanced countries, the stimulation of military-technical developments that can be quickly produced by the national industries for dissemination to the civilian area. Fortunately, this has occurred often in Brazil, and (as the Navy Minister noted) Brazilian society "has benefited from them, while virtually unaware of the fact. This occurred in informatics, in the aeronautics industry (obviously, this is not the case in the

Navy, but in the Air Force), and in naval construction, and it is taking place in the nuclear area."

In first world countries, there are various ways in which a government protects, gives incentives, and subsidizes its industry, as was remarked by Deputy Nelson Proenca, primarily subsidizing its leading edge industry and those with sensitive technologies. Different tactics are used: "The Japanese adopted methods to protect their industry (...) but they never made that protectionist practice explicit in laws; and, as a result, they have always suffered far less international pressure."

In the United States, he also notes, "The protection of its leading edge industry is achieved through spending and the atrocious budget that it has for defense." He went on to say that we know that, through the defense program, "a subsidy has in fact been created for U.S. leading edge industry. Virtually all the large technologically advanced industries in the United States share somehow in that pie, namely, what is spent every year on national defense." Also notorious there is its dissemination to other non-military industrial activities which, in one way or another, use funds for military developments in the areas of the Army, Navy, Air Force, and aerospace agencies, all with large segments of leading edge and highly sensitive sectors.

The shortage of funds that has been occurring in the country for some time will cause appreciable lags in production for the civilian segment, due to the absence of an economy of scale, despite the fact that, in principle, it does not lack the technological expertise for absorption and development.

The Navy, like the other forces, has pursued the policy of technological dissemination, with the opening of industrial companies, through a cooperative contract, for the manufacture of countless products. They range from the simplest with slight added technology to the most sophisticated of the leading edge and sensitive type. The Navy minister, Admiral Mario Flores, when citing or commenting on the nuclear program conducted by the Copesp, declared: "This is a program that is being conducted, coordinated, and administered through the Navy's organizational and managerial capacity. It has been an excellent example of the validity and national usefulness of this way of viewing the problem." He also claimed that, "From 1979 until 22 May 1991, $418 million was spent, 84 percent of it in Brazil, and $185 million (hence, less than half) on the fuel cycle." He went on to say that those funds for the fuel cycle came primarily from the ex-Sadem, currently the SAE, of the Presidency of the Republic. Therefore, $233 million was spent, 78 percent in Brazil, on reactors and their components. This represents an immense incentive for the national industries in the nuclear sector.

One factor that is common to the Armed Forces and extremely important to the success of any scientific and technical program is the continuity, the persistence, or even the setting of a clear strategy for results. That fundamental goal has been attained, despite the meager public funds, or those from financing. The tactic adopted by the Armed Forces is a common example in other countries, such as Japan, where administrative continuity, managerial capacity in science and technology, and the establishment of clearcut goals and strategies, combined, in particular, with a great political will and a healthy nationalism, have been factors for success. That strategy for action should become a basic rule in the public sector, whether in universities, or research and development centers, in coordination with the national industries, in a sector as fundamental to the destiny and the very sovereignty of a nation as the mastery of science and technology. All this entails stability, which generates an enormous proliferating effect on all levels of society which, after all, is the source of the Union's resources.

3.2.1.1 - Conclusions

a) The Navy's Scientific and Technological Development Plan is the course of action used to coordinate and conduct the S&T programs, all in accordance with the objectives and goals integrated into naval training. However, as has been indicated, continuity is necessary. It is important to have a multiannual investment program, even if comprised of resources on the medium or even low level, but in a continuous fashion.

b) The maintenance of research and development equipment is important, because repairing it costs money and time, and, in some instances, becomes an impossible task.

c) Long term planning for human resources is essential, because training and qualifying professionals require time and money.

d) The guarantee of fair salaries and a suitable career plan with flexibility in the legislation on personnel hiring require future changes in the Law on the Single Juridical System.

e) The requirement for financial resources coming from development agencies and from the budget itself should allow for the continuity of the scientific and technical programs in each specific field.

f) The continuous expansion of human resources to meet the higher level requirements, both civilian and military (annual hirings) should be a constant concern.

g) Continuous integration, through agreements and accords with universities and civilian research centers in Brazil and abroad, to procure new technologies and to import technical documentation, should be aimed at the internal dissemination of information.

h) The opportunity to contract foreign professionals with acknowledged capacity (a successful experience in the Navy) is essential for the S&T sector.

i) The degeneration of the industrial pattern in Brazil, especially in terms of connections among businesses, in the context of a dependent model, with excessive concentration, has prevented access for new and small companies to large segments of the market. This limits the dissemination of technology in the country, particularly in the Navy.

j) Public funds from any source or of any kind should always flow to the research and development organizations by way of a ministry, which should pass them on to the executor entities. It should define their goals and control the progress of the contracts in all areas in which scientific and technical activities, and research and development, are being carried out, in fields such as communications, agriculture, and health, and not merely those of strictly military (naval) concern.

k) Military accords, such as the one of 1952, should be avoided. Some were justified by the threats of a state of war experienced by the world. The furnishing of equipment, always with outdated technology, causes a major disarray in the internal scientific and technical development programs. In many cases, it impedes local manufacture, in view of the restrictions that always accompany or are part of those accords.

l) The Ministry of Navy should only promote applied technological development with the available human resources, and not take the path of pure science: an endeavor which, according to the expositor, belongs to the university.

3.2.2 - Aeronautics complex

3.2.2.1 - Aeronautics industry

Embraer, the Brazilian Aeronautics Company, Inc., since its founding in 1969, produced and delivered a total of 4,382 aircraft, of which number 1,410 were heavy (the Brasilia and Bandeirante), and 2,972, light (the Xingu, Tucano, Xavante, and others). The company is headquartered in Sao Jose dos Campos, with facilities covering 253,800 square meters. It employs 8,300 persons and produces four aircraft of its own design: the EMB 20/A Ipanema; the EMB-110 Bandeirante, the EMB-120 Brasilia; the EMB-312 Tucano; the AMX; in an initial phase of production (prototypes), the CBA-123 Vector; and, in a development phase, the EMB-145, its first commercial jet.

As subsidiaries, it has: a) Neiva Aeronautics Industry, Inc., in Botucatu, to produce light planes of its own design and other models, under a Piper license; b) Embraer Equipment Division - EDE, in Sao Jose dos Campos, where landing gear for the Tucano and the AMX is produced, as well as hydraulic equipment; c) Embraer Aircraft Corporation, - EAC, based in Fort Lauderdale, Florida (U.S.A.), which engages in sales and provides technical assistance for the company's line of products in North America; and, 6) Embraer Aviation International - EAI, which furnishes support in the form of technical assistance to operators of products in Africa, the Middle East, and Australia, based at Le Bourget Airport, in Paris.

Embraer came into existence, technologically, in 1946, with the creation of the Aeronautics Technological Institute - ITA, which was later taken over by the Aerospace Technical Center - CTA. The latter belongs to the Deped [Research and Development Department], an organ of the Aeronautics Ministry, responsible for ensuring the attainment of the aerospace policy objectives in the sectors of science, technology, and industry. Those organs will be more closely studied in an individual chapter.

During 1954, the Institute of Research and Development - IPD, was created, to lend support to aeronautical engineers in the application of their knowledge to research. This was the basis for the construction of the first metal twin engine turboprop plane, which made its first flight on 22 October 1968.

According to a statement by Colonel Osires Silva, its president, who has been involved in this sector for a long time, from 1968 until early 1969 the government authorities attempted to interest private enterprise in financial investments, for the purpose of setting up a company to produce this first plane. Thus, everything was done to enable the company to have its origin in private enterprise.

With its market assured, originating in orders from the Aeronautics Ministry, which was endowed with the state's purchasing power, now common in any country wishing to develop in S&T, Embraer was created in 1969 (19-8-69). Through a later government decree, it found itself benefiting from credit granted from the income tax owed to the Union by corporations, commensurate with the magnitude of the purchase of the company's stock shares.

All that enormous effort made a great conquest possible for Brazil: to be ranked among no more than 25 of the world's over 170 countries with an aeronautics industry. In January, 1970, Embraer began operating; and, in 1973, it delivered to the Brazilian Air Force the first three Bandeirantes out of an order for 80 units.

Embraer unquestionably grew on the basis of the state's purchasing power, aiming at technological expertise in the aircraft sector. However, that growth did not originate solely from its supplies of equipment purchased by the Aeronautics Ministry, but also from those to countless Brazilian and international clients. In cooperation with Italy, Embraer began manufacturing the Xavante; and in 1977, it started producing the Xingu, also exporting this latter model to France. In 1984, the Brasilia was introduced in Europe, coinciding with the flight of the AMX in Italy during the same year. The Brasilia plane has been a sales success, constituting the company's leading product, with technical features far superior to those of its main international competitors. The Tucano planes also achieved good sales, including supplies for France and Great Britain.

In the AMX project the most important aspect for Embraer was the transfer of technology, assimilated through the expertise existing in two areas alone: the technology in the jet plane's manufacture, and the work on compound materials. This enabled Embraer to gain competitiveness with countries such as Japan, Germany, Great Britain, and the United States, in the manufacture of fine mechanics products.

Despute the enormous sales success, until the time of this CPMI, Embraer was undergoing an anxious situation, faced with financial problems stemming from the high costs involved in research and development on its new

products. No aeronautics industry in any nation of the world exists without subsidies from the government, in view of the countless proceeds generated in the form of production and dissemination of leading edge technology.

This holds true in Sweden (Saab), Canada (De Haviland), and the United States, in the form of large orders, both civilian and military; as well as the Netherlands (Fokker), and countless other countries. These are subsidies received by international industries, something that does not apply in Brazil. Embraer receives only payment for the product delivered, on the part of the government and from private orders. The company has no groups that could finance the purchase of its products by future internal or external users. All this has caused a financial crunch in the company, with serious implications, generated by the deficit between spending on production and development and the proceeds from the sales billing. Consequently, it ended up suspending supplies, even of parts and components for the firm's production line.

Dr. Jose de Souza Santos, financial director of Embraer, remarks: "The history of the aeronautics industry shows that the companies that shut down disappeared." From all indications, this situation is due to the fact that Embraer took on so many projects, although a major addition of technology resulted from them. It may also possibly be due to the decline in production and orders, and the retention of an overly large group of employees for the reduced production. Compounding this are the international reactions from the Gulf War, and the lack of financing for exports (Befiex [Commission for Granting Tax Benefits to Special Export Programs]). From recent reports it has been learned that this tax benefit was restored to the company by the Ministry of Economy.

That assistance is indispensable. There is still a need to transfer supplementary funds in the form of a loan, so that Embraer can honor payments to its suppliers. This would prevent the creation of a tragic, possibly fatal vicious circle, because it needs a contribution of $800 million, $600 million of which is required for the short term (suppliers and banks).

As the deponent declared, regardless of this emergency situation, Embraer, through the Aeronautics Ministry "requested the opening of a special credit, or the earmarking of funds for the company's capital formation in the future budgets." Apparently, this request will receive the full support of the National Congress, because it is a means of keeping alive a company that has already conferred so much glory and pride on Brazil. Furthermore, it should be noted that Embraer benefited countless contracted and subsidiary firms as a factor for disseminating technology. Finally, there is the enormous risk of international greed, possibly causing the company to be transferred to private enterprise, not in Brazil, but in other countries.

Conclusions

1) The results produced by the company were highly satisfactory, because, from an abandonment or lack of support from private enterprise, there emerged a plant which, with the use of the state's purchasing power, managed to acquire technological expertise.
2) Embraer was founded at a time of favorable economic conditions. Owing to the volume of investments, anything similar would be impossible at the present time, because of the program for the state's withdrawal from the economy, which is the present government's goal.
3) Embraer provided the dissemination of technology through associations with countless firms, based on the most varied types of contracts for the manufacture of aeronautical components.
4) The company urgently requires capital formation, so as not to lose the investments already made, and thereby to prevent a technological lag in a dynamic field with a high degree of competition.
5) There is a need for the Federal Government to resume the orders, as an exercise of the state's purchasing power, especially for the AMX, CBA-123, and EMB-120 projects.
6) There is a need for investments to develop the EMB-145 (commercial jet), in view of the clamoring market that is approaching for this category of aircraft, for use both in Brazil and abroad.
7 Financing lines for export (of the Befiex type) need to be provided, in view of the fact that this is a high tech product, and considering the return, with foreign currencies originating in exports.
8) An improvement is required in salary conditions, which are now extremely imbalanced, with serious implications, causing the departure of highly qualified employees and professionals to other international companies, such as Japan's JAMCO.
9) A survey should be made of the difficulties for exports of its products, because the foreign competitors offer advantages created by the banks of their respective countries; something that Embraer does not obtain from Brazilian private or state banks.
10) Continuity is needed in financial investments for R&D promotion, to prevent technological losses and lags in a critical leading edge sector, and the resultant collapse of this segment.

3.2.2.2 - Education, research, and development in the aeronautical sector

The Deped - Research and Development Department - of the Aeronautics Ministry is the organ responsible for ensuring the attainment of the aerospace policy objectives of interest to the Aeronautics Ministry, in the sectors of science, technology, and industry.

It has as subordinate organs the Barreria do Inferno Launching Center - CLBI; the Alcantara Launching Center - CLA; and the Aerospace Technical Center - CTA. The latter is comprised of the Aeronautical Technology Institute - ITA; the Aeronautics and Space Institute - IAE; the Institute of Advanced Studies - IEAV; and the Insitute of Industrial Development and Coordination - IFI.

Countless types of work are carried out by each of the institutes, including activities ranging from development

of alternative fuels, oils, and lubricants to development of aircraft, launching vehicles, homologation, and aerospace meteorology.

It was indicated that the Aeronautics Ministry has had as a fundamental policy since its creation the achievement of technological autonomy, for the benefit of the national aeronautics industry, as a basic requisite for reinforcing Brazil's aerospace power, based on guidelines, namely:

a) The S&T effort must be continued. b) Reinforcement of the national aeronautics industry is essential. c) Special attention is to be given to the effort for nationalization, which is essential for the reinforcement of aerospace power. d) An incentive is required for research and development, stimulating them with the corresponding sector of Brazil's industrial plant. e) Mobilization of the industry must be achieved constantly, assigning to the sector substantial plans in keeping with the requirements for aerospace power and compatible with the country's situation.

It may be claimed that the success accrued in the field of science and technology in the military area is due, among other factors, to administrative and managerial continuity, which the various projects and activities have had for a long time. On the other hand, in the civilian area per se, the action has been different: it may be summarized as having a marked pendular movement, sometimes more, sometimes less, with a dangerous variation in scope.

What Air Brigadier Sergio Ferolla asserted is evident in the Aeronautics Ministry: "We know that we can only attain what the Aeronautics Ministry calls aerospace power if we have science, industry, a research laboratory, a base, and broad technological backing that will enable Brazil to make its aircraft and use its aircraft when it wishes, and not when foreign powers say it can."

It is interesting to note that our having the decision-making power is also quite important, even if it is accompanied by spontaneous international cooperation.

As was commented in the preceding chapter, Embraer was born of this gigantic effort, marked by determination and objectivity, and carried out primarily with the basic premises established by the Aeronautics Ministry.

The Aeronautics Ministry's Research and Development Plan, monitored by the Deped, which is the reason for its scientific and technical success, consists of:

1) Training program: including the formation of human resources on the various levels and in the areas required.

2) Development program: including projects of concern to the Aeronautics Ministry, according to the basic requirements set by the EMAER - Air Force General Staff, namely:

a) Rocket development: Probe I, II, III, and IV; and the Satellite Launch Vehicle (SLV);

b) Aircraft development: aimed at the manufacturer of the Tucano (T-27), the Brasilia (EMB-120), the AMX, the CBA-123, and the EMB-145 (jet);

c) Radar development; aimed at production of meteorological and aeronautical radar for the national industry;

d) Engine development: projects for making the high-power (240 hp) Otto to ethanol cycle and the low power turbine for pilotless planes practicable.

3) Industrial program: which consolidates all the development projects, while simultaneously transferring to industry the responsibility for the manufacture and supply of the finished project, assigned to the IFI - Industrial Coordination and Promotion Institute - an organ of the CTA, in Sao Jose dos Campos;

4) Infrastructure program: includes action to construct the organization of physical space, facilities, laboratories, launching bases, aerodynamic tunnels, and plants for producing propellants.

From what has been explained, one notes that the S&T policy in the Aeronautics Ministry, once set by the competent authority, has remained firm, without neglect, and, primarily, without discontinuity; so that the desired results may be achieved with the least investment of the always scarce financial resources. Thus, it has affirmed: a) an industrial policy; b) a technological expertise policy; c) a financing policy (BNDES and Finep); d) an educational policy; and, e) a regional development policy.

The results accrued are obvious, with the products and projects that have been and are being developed, such as aircraft, rockets, components, and infrastructure, as well as enormous support for the aerospace plan, which will be discussed later.

As was asserted at the outset, the aeronautics sector is concerned with designing, developing, and then transferring to industry, when it is not executing it cooperatively, the product that may have either a civilian or a military application. In short, this represents a powerful tool for technological dissemination and heightened technological expertise.

Prospects, scenarios, and obstacles: The complexity of military systems per se causes the practical results between the basic scientific and technological components and their end products to take considerable time to come to fruition, approximately 8-15 years. This is due to the high level of sophistication involved in aeronautical and aerospace systems: all part of a complex chain of industrial production, aimed primarily at nationalizing the product, for reasons of security and sovereignty.

The scenario that Brazil faces vis-a-vis the large industrialized nations of the first world is one of constant difficulty. In fact, those countries do not want new competitors or partners to enter the technological and economic "niches." They do want the "niche" of $6 or 7 billion per year, from the aerospace sector, to remain closed. They do want our participationm, but in another area, as clients and/or users.

Hence, it was concluded from the depositions that, concurrently with the growth of the national potential, there has been an increase in the reactionary mechanisms abroad (Air Brigadier Sergio Ferolla claims) in the form of:

a) problems with flow of information;
b) economic pressure;
c) threats and retaliation;
d) artificially created problems.

Owing to this series of reactions that Brazil has experienced in the aerospace area (see aerospace complex), there is a sense of the non-existence of total control over certain sensitive and leading edge technologies, such as rockets and satellites. This is revealed particularly when services or components essential for their development are requested.

3.2.2.2.1 - Conclusions

The Ministry of Aeronautics has sought, within the legal realm of action, a firm coordination, with stress on the continuity of investment in human resources, and the development of technology, not for its own sake but rather for the national industry. This must be in the form of products geared to the requirements of the civil and military aeronautics market, in keeping with the capacity and technical status of the industry in the country.

3.3.3 - Aerospace complex

The Brazilian aerospace program is based on the activities and projects developed by the CTA and the INPE, both installed in Sao Jose dos Campos; the latter with branches in the form of stations in various Brazilian municipalities.

One of the deponents from that complex, Marco Antonio Raupp, ex-director of the INPE, in a noteworthy summary, claimed:

"Coordination between scientific research, technological development, and industrial activity is, for the most part, achieved through the leading edge industries. It is for this reason that the governments of the developed countries provide full support to their space sector. Through programs for development of space systems, those governments mobilize and coordinate efforts among universities, technological research institutions, and leading edge industries."

Because of its territorial size, Brazil is inclined toward space; at present, however, it is a major user of space systems with communication satellites and earth observations (meteorology, cartography, agriculture, etc.).

Also according to Raupp: "Brazil has been making moderate investments in the sector for 30 years, but we are now faced with a crisis stemming from the fact that the first programs established, the principal goals, and the programs aimed at those goals, which are technological development programs, representing a second phase in our space activity history, are at a virtual standstill." (Raupp, session of 8-6-91).

In 1979, the Federal Government approved the Complete Space Mission -MECB, consisting of the development of our satellites by INPE, and of the Satellite Launch Vehicle (SLV) and the Alcantara Launching Base. These were developed with the cooperation of the Aerospace Technical Center of the Aeronautics Ministry.

Also prepared was an accord for scientific and technical cooperation with China, in which Brazil participates on an equal footing in the development of two operational 1.5 ton satellites for earth observation and monitoring of natural resources. It is competitive with the SPOT (French) and the LANDSAT (American). It is the CBRES project - China-Brazil Earth Resources Satellite, budgeted at $150 million; with 70 percent of its final cost incumbent on China, and 30 percent on Brazil.

During the course of his deposition, Dr. Marco Antonio Raupp, in order to better explain the status of the aerospace complex in Brazil, asked four questions, which he himself answered.

1) Why should Brazil go into space?

There are countless reasons, but Brazil is a major user of space systems. It has two telecommunication satellites purchased abroad, and two more ordered, with $400 million committed to this global system. It operates with French and American satellites to monitor important applications, such as forest cover, mineral investigation, and cartographic updating, with stations distributed all over the national territory. Moreover, the dissemination of the innovations generated in leading edge sectors is essential for providing nascent dynamism.

2) Do we have the facilities for going into space?

For the reasons described at the beginning of the aerospace sector report, Brazil has been investing moderately since the 1950's. To maintain a moderate space program, it would need to invest approximately $150 million per year. The leading edge industry in Brazil is smaller than is to be expected in a country of a size similar to ours; but all the developed countries resort to space programs as a means of creating opportunities for the technological development of their industry.

3) Does Brazil have a political will to go into space?

According to the expositor, the response is given within limits. This has not been proven since the creation of the MECB program, because of the discontinuity that this mission has been experiencing. There is a lack of synchronization between the development of the launcher and the first satellite, which has caused constant postponements.

The same situation has occurred in the CBERS - China-Brazil - program, in which the disbursement on Brazil's part is not being fulfilled.

The Secretariat of Science and Technology has not been evincing an interest either, because, an appropriation of $2 million was submitted for 1991, whereas the amount planned was to be $20 million.

There is a total lack of coordination and management. The then Ministry of Communications gave no support to the incentives program that would enable Brazilian business

firms to partiicpate in the manufacture of the satellites: a fundamental link to the technological expertise in this sensitive area.

4) What is to be done in order to go into space?

To summarize, he concluded:

a) Acknowledge the importance of the MECB; b) Maintain efforts to develop the launch vehicle; c) Resume the CBERS program; d) The National Congress should ask the Executive Branch to devise a proposed program for a pre-operational telecommunication satellite; e) Create a Space Agency to actually materialize the political will that is so necessary for the Brazilian space program.

Conclusions for the Sector - Causes of the Lag

- Progressive reduction in investments; - Delay in the VLS program; - Instability in space policy; - Discontinuity of the space program, causing waste of investment without results; - Flight of personnel, caused by low salaries and widespread frustration; - Developed countries are attempting to prevent Brazil from attaining competition in the sector, and also from entering the economic "niches" ($6 billion per year); - The sale of several rocket components to Brazil is banned, in view of the phase that it is attempting to reach.

Solutions

- Establishment of a personnel policy that will encourage the human resources to remain in the sector, and the personnel not to be imbalanced;
- Allocation of a minimum of $150 million per year to make it possible to resume the projects and activities;
- Preparation of a space policy by the National Congress, and promotion of its implementation;
- Creation of an organ of the space agency type to implement and manage the policy, now dispersed among several organs, assimilating the functions assigned to the COBAE
- Brazilian Commission for Space Activities - and with some authority delegated to the Ministry of Infrastructure (Communications Secretariat). All this is aimed at reinforcing and activating the state's purchasing power: something common in the more developed countries;
- Maintenance of the Sino-Brazilian accord (CBERS), the means whereby Brazil will be able to acquire the necessary competitiveness for future space developments, dissociated from those currently retaining the market (niches), from whom the country will certainly not receive any type of space-related technical cooperation.

3.3 - Capital goods complex

The sector was represented by Mario Bernardini, an industrialist and vice president of Abimaq and Sindimaq, headquartered in Sao Paulo.

It was indicated that the capital goods sector is one of those applying the most technology in their production. Generally speaking, the Brazilian manufacturing and mechanical industry had been demonstrably updated in its technological parameters before the beginning of the 1980's, in comparison with the more developed countries. Currently, many companies are being forced to disinvest, and even to stop producing; becoming mere commercial representatives of multinational manufacturers. This is serious, because it involves a sector that had annual billing (historical average) of nearly $20 billion, constantly, until the end of the 1970's. That figure declined to $18 billion during the 1980's, when it was employing 300,000 persons. By 1989, the employed personnel dropped to 290,000 persons; but now, a year after the modernizing government's arrival, its billing is claimed to total approximately $14 billion (a 30 percent loss), and its employees, 230,000.

The capital goods sector requires specialized personnel, who take "from three to five years to be trained. The training in the company requires from three to five years to reach a moderate level."

What occurred in the sector was the result of a series of mistakes made and events occurring throughout the 1970's, according to Mario Bernardini:

a) A diagnostic error, whereby we counted on the so-called comparative advantages of the economy, based on the resources in the subsoil, abundant electric power, and cheap labor available;

b) Investments in status symbols, such as the Nuclear Program, the Trans-Amazon, and many others, to the detriment of human resources;

c) The state's concurrent argument as an investor, during the early 1980's;

d) The revolution in information, education, and training, which were not absorbed by our leaders. This enabled countries such as Japan, Italy, Korea, and the Asian Tigers in general to acquire an educated people;

e) The financing policy in Brazil, which raised the costs of capital as much as one and a half times over those of its international competitors;

f) The lack of investment in human resources, more important to high tech development that the use of the latest generation equipment, which in many instances is not so important;

g) The problem of the internal market, based on the long economic crisis experienced by the country, in which business firms are losing money and operating with 40 to 60 percent idle capacity;

h) A lack of conditions and funds to enable business firms to invest in research and development;

i) Collapse of the tariff barriers confronting national industries, the limited domestic market, and also external competitors offering their products with high subsidy rates and tax benefits provided in their respective countries of origin;

j) Lack of timing and sensitivity on the part of the Federal Government, in its attempt to introduce the industrial plant to modernity and competitiveness suddenly, without first offering national business firms the necessary instruments for confronting the highly competitive foreign market;

k) Education as a priority goal, because we cannot wait any longer to offer the people a better standard of living, so as to compete with what we are going to confront.

The preceding proposals would serve to make possible the scenario that the country should achieve for the sector within a 10-year period.

Finally, to be underscored are the suggestions and comments contained in Mario Bernardini's deposition:

1) In the cost/benefit ratio, modern management techniques allow for good results over the short term with little investment.

2) If we analyze the world market and the volume of international trade, the latest generation tecnology accounts for less than five percent of that volume. The rest consists of next-to-latest technology and even that preceding the next-to-latest generation. We must realize that we are up-to-date in this respect. We have equipment, we have goods, and we have 'commodities' in which we are highly competitive.

3) The strategic sectors of industrial development are, basically, those of capital goods, electro-electronics, and informatics.

4) No country is completely self-sufficient: Japan imports American and German machinery, Germany imports Japanese and American machinery, and so forth. But all of them have a strong base of capital goods and equipment.

5) Therefore, opening those sectors up to international competition at a time of cyclical weakness is a crime of treason.

3.4 - Automotive complex

The Brazilian automotive sector currently accounts for 7.4 percent of the industrial GDP, compared with 11 percent in 1988. During 1989-90, there were 180,000 direct jobs; and, as for indirect jobs, that number reached 5.6 million involved in the automotive sector. Today, nearly 127,000 persons are employed in it. Taking as an average 3.6 dependents per family, 23 million Brazilians maintain direct or indirect relations with the automotive industry.

Nearly 21 million units have been produced here since the industry's establishment. The country currently ranks 11th on a worldwide scale, with production of approximately 1 million vehicles. Meanwhile, Japan, which does not have any type of mineral resources or even energy resources, produces 14 million vehicles per year.

During the early 1980's, it was conjectured that three countries would have an active, influential presence on the world market: Brazil, Korea, and Mexico. Korea has now surpassed Brazil in the sector, by 20-30 percent. In 1980, that country was producing 10 percent of our total production at the time, whereas now that index exceeds Brazil's present production by 30 percent.

Mexico, which had had a slower initial growth, despite having confronted the same problems, now produces slightly over half the Brazilian total. However, the expectation is that, within four or five years, Brazil will be surpassed because of Mexico's integration with the U.S. and Canadian markets, as well as by the fantastic manner in which investments are being directed toward the Mexican automotive sector. It should be stressed that the Mexican Government, to achieve the present level of its automotive industry, devised a successful policy of deference to multinational investments. As a result, a sophisticated technology in terms of products and processes is making a high export volume at competitive prices possible.

A similar strategy was adopted in the mid-1950's during the Kubitschek government, when countless companies became established here, for the purpose of taking over the Brazilian internal market and promoting exports. Three factors that were abundant and, at the time, preeminent, contributed to this: cheap labor, raw material supplies, and installed energy. These factors made room for the technology of the process, now dominated by Japan and the Asian Tigers.

A final example of automotive production comes from Argentina, which has now attained a production of 380,000 cars per year. Owing to an erroneous productivity policy, it managed to destroy its automotive plant. In 1991, it was expected to produce about 85,000 vehicles, insufficient to meet the needs of its internal market. This was due to a myopic policy of openness, under the guise of "competitiveness." In other words, Argentina opened its market for more modern products, without first having provided competitive conditions for its own industry. In fact, competitiveness has come to exist on the basis of technological progress, and a policy of subsidies, offering salaries and collecting direct and indirect taxes, as well as making suitable use of the internal market as a booster instrument, and many other factors. This policy of openness and competitiveness should be conducted in a highly nationalistic spirit, as it was handled by Japan where, in particular, the retention of internal employment was not precluded by the use of labor on any level of execution.

In the economically developed countries, 5.2 percent of the population has the capacity to purchase a new car. In the U.S., that index is 6.5 percent of the population; whereas, in Brazil, it does not exceed 0.5 percent. In our country, the number of vehicles per inhabitant is one per 11.4; far lower than in the United States (one per 1.3).

Brazilian exports have now reached 3 million vehicles, representing a billing of $27 billion, with a foreign currency balance of $13 billion. During 1990, only 192,000 units were exported; whereas, during the same period, Japan exported 6 million, Germany 3 million, and France 2 million.

The automotive plant and its principal enclaves are located in the Sao Paulo ABC [Santo Andre, Sao Bernardo do Campo, and Sao Caetano do Sul] region, in Curitiba,

Betim, and Caxias do Sul, and in Paraiba Valley. The installed capacity in Brazil is from 1.3 to 1.5 million units per year, possibly attaining as many as 2 million. The economic conditions do not allow the annual production to exceed 1 million units, with an incomparably smaller profit scale.

By 1956, the country was importing its total consumer market requirements. With the industry established, the sector grew until 1980. During 1960, 133,000 cars were produced; in 1965, nearly 186,000; in 1970, about 416,000; in 1975, 930,000 cars; and in 1980, 1.16 billion. This was partially due to the fact that Brazil began receiving some sizable investments in modernization of products and production processes, aimed at a greater export of those products to the leading countries (the United States and Europe). It accredited investors who could compete with the Japanese based on the use of relatively cheaper labor, one of the comparative advantages.

The industrial policy selected (that of a gradual substitution of imports with an increased index of product nationalization, accompanied by some facility in exchange for the purchase of machinery and equipment for the industry's installation) was due to the foreign currency crisis of the 1950's. At that time, the country was exporting agricultural products and raw materials without any industrial processing. This resulted in a poor performance in the export pattern, entailing difficulties with importing, particularly that of finished products. With the opening of an internal market to the multinational industries of the time, combined with competitive factors such as cheap labor, raw material, and sufficient energy, Brazil evoked the interest of those companies. Some, with small assembly and finishing lines, became installed on an industrial scale, taking advantage of the opportunities offered by the Brazilian Government.

It should be stressed that the industry that was installed "avoided the risks of investments with unpredictable costs and uncertain results." Therefore, it brought the country "the disadvantage of not seeking to generate its own technology, but rather depending on foreign technical assistance. With that, we were receiving the 'know-how' in a black box, without the 'know why': without knowing why it was being used."

Consequently, the country soon gained a sizable industrial plant, but one marred by an enormous dependence and vulnerability with respect to process and product. That policy of rapid installation only managed to evince the first signs of vulnerability when the process of exporting automotive manufactures began. In this respect the country is currently faced with a highly competitive market, with more advanced technology, in a suicidal competition: in other words, with the suppliers and providers of technology themselves in the leading countries (Europe and U.S.). In brief, it would be incumbent on Brazil to supply only the domestic market, and not to have the right to compete on foreign markets. That far-fetched image is exactly what is happening at present.

The industrialists that accrued impressive results in the sector, such as Light Metal and Cofap, also directed by their founders, Jose Mindlin and Abraham Kazinsky, respectively, deviated slightly from the route plotted by the industrial policy.

Observing that there was a reduction in the providers of technology who accepted its transfer only if there was participation in the companies (which was not forbidden), the directors of those firms decided not to accept any kind of forced participation. The president of Light Metal, in his deposition, remarked: "Association with a foreign company is something quite normal if it evolves from a good relationship and if there is an interest on both sides, but not as a condition for the provision of technology." The Cofap director submitted the very same line of reasoning. Unfortunately, the Brazilian Government at the time lacked a protectionist perception for the nascent industry: It was coming in from the outside, like a strong hurricane, occupying space, and creating technological dependence. And it did not even afford an opportunity for an incipient technological expertise, because of the still precarious situation in which the universities and the research and development institutions found themselves.

That first step in industrial policy, erroneous because no model, strategy, or objective was adopted, was to be repeated for decades. Proper attention was not paid to the national industry, which should have received full support from the government in the form of incentives and subsidies. A few national pioneers who attempted to install and develop technology in the automotive sector were liquidated by the market, which sold out to the multinationals. A recent exception, in 1985, was the Gurgel automobile industry which, together with altruistic and idealistic industrialists, achieved some national and international success.

No country that seeks to develop a certain technology and to become established in a certain leading edge sector, or even one with traditional technology, can give up incentives and some subsidies. That was the treatment obtained by what are now the first world countries. Strictly speaking, the policy of incentives and subsidies should be combined with policies for technical expertise, financing, and education.

An exemplary country for coordination of policies is Japan which, immediately after World War II, had no technology. However, through contracts and imitation, it began developing its own technology, first copying and later improving. As a result, it succeeded in acquiring fantastic technological expertise. Its production amounts to nearly 14 million automobiles per year. It has now invaded the U.S., Canada, and Europe, with products that are of better quality and technologically more advanced.

Incentives should be everywhere, if the country wants to gain markets. It is essential for the company to keep its decision-making power in the hands of nationals. A branch of a multinational company installed here will never be equipped to compete with captive markets, manipulated by its main offices or headquarters. Moreover, the Brazilian automotive industry is struggling with the production scale: whereas nearly a million vehicles are produced here, Japan produces 14 million.

Incentives have an effect when the tax burden is analyzed. A national automobile today pays about 39 percent to the public treasury, whereas in Italy that charge is 15 percent; in Japan, 8 percent; and in the U.S., 5 percent. Furthermore, all the manufacturing costs are higher than those in the rest of the world, such as non-flat steels, aluminum, synthetic rubber, resins, natural rubber, and the other raw materials. In the case of components as well, there are considerable differences in the end prices. As a result, the national product is more expensive, and not competitive from a commercial and technological standpoint.

Another support used by the first world countries is financing of exports, often linked with powerful banks that benefit the companies with credit lines. In Brazil, there was the Befiex for some products. What exists now is the policy of extremely generous quotas, which allow products that are more modern technologically to reach the Brazilian market. The ideal would be for those imports to enter the country, but to be defeated by the national industry.

The Brazilian automotive industry is attempting to use technology that has already traversed the world, that already exists, and that is sometimes old. This is due, primarily, to the results of the technical assistance policy that marked the beginning of this industry in Brazil. Few had the vision of Light Metal and Cofap which, with decision-making power and because they were genuinely national companies, triggered a major effort to generate their own technology, with the installation of technological development centers. This made it possible to manufacture parts and accessories with their own designs, instead of meeting the specifications of the clients: the assemblers. Those companies succeeded in obtaining special niches in highly competitive sectors, such as parts for diesel engines, executive aircraft, and tractors, now with worldwide acceptance. However, there must be caution, because it is impossible to keep pace with the development of the more industrialized countries without using their technologies.

Technological expertise for Brazil is a factor for survival. No business firm, industrial organization, nor even a country can be independent or self-sufficient in technology. As the president of Embraer claimed in a deposition to the CPMI made at the company's headquarters in Sao Jose dos Campos, "National and/or international cooperation will always be necessary and, furthermore, fundamental."

The president of Abicomp [Brazilian Association of Computer and Computer Periphrals Manufacturers], Carlos Rocha, directed his deposition toward the following consideration: What would become of the fantastic success achieved by the Japanese and Korean industries if those countries depended on components manufactured by their competitors, located in the major world markets, where the local industries are being destroyed by the competitiveness or competition of the aforementioned countries? Would there be a license for new products?

It is difficult for Brazil to achieve competitiveness, when it applies 0.6 percent of its GDP to scientific and technical development, while the more advanced countries are investing two to three percent.

Few companies in Brazil invest a portion of their billing in technological development. The world standard in the informatics field, to name just one sector, is 10 percent. Some industries in the automotive sector invest from two to six percent, but only those possessing research and development centers, such as Cofap and Light Metal.

In his deposition, Jacy Mendonca, of Anfavea [National Association of Automotive Vehicle Manufacturers], commented: "The Brazilian automotive industry generated a demand for skilled labor and personnel training. As a result, it developed technical schools, research institutes, and even personnel training and development institutes, in its own factories; because the existing technical educational structures did not meet the labor requirements needed for the sector."

A similar observation was proferred by Abraham Kazinsky. He claimed that the Cofap group contributed to the Senai [National Service for Industrial Apprenticeship] system, concurrently holding specialized courses for its employees.

According to the deposition given by Jose Roberto Ferro, from the Materials Engineering Department of the Federal University of Sao Carlos, "It is essential for educational and research institutions both to develop their own expertise and to improve that now rather distant relationship between the industries and our universities."

Pooling efforts to produce knowledge that will be useful from the standpoint of international competition as it affects Brazil's industrial plant necessarily entails the training and improvement of human resources. They are more important today than financial and technological resources.

The relationship between universities and business firms should be better than it is now. Strictly speaking, a tripod should be established, comprised of the state, university, and business firm. That tripod will be efficient only if there is a stimulus for basic and applied research. The concept of technical cooperation should be promoted in that cycle: as a natural, mandatory substitute for mere technical assistance, which generates and causes technological dependence and backwardness.

The Brazilian automotive sector developed as part of a nationalization of the product. This did not mean that the good manufactured here, despite the growing or total rate of nationalization assumed by each company, represented creativity, or a design generated by the national technician. It all followed the process of so-called technical assistance, in which the "know-how" predominated over the "know why": that is, authentic manufacturing concessions with a patent abroad, registered by the parent companies.

The depositions made it possible to conclude that the Brazilian automotive industry is not competitive. According to Jacy Mendonca (meeting of 25-6-91), "We can't compete in prices, because we lack competitive costs; we have no technological competition, because we have been denied the opportunity to meet the requirements for that competition."

Then why does the Anfavea representative so strongly desire, as he declared previously, that the automotive industry, which is really a "market reserve" in reverse, be victorious and not defeated; while he, as a Brazilian, is not conveying that notion, directed toward the informatics industry? Is this on the basis of the market reserve?

The informatics industry is identified as the main cause of the technological lag, having a product generated without international competitiveness: The electronics used starts from scratch; the electronic systems for torque control and brakes cannot be applied; and the electronic board, temperature control, and electronic transmission are dreams far from becoming operative. As the Anfavea president remarked: "...They are banalities in the international car, but we are not in a position to use them on the national market." All of this is poured into the "market reserve." It is well known that, "The Informatics Law makes the reservation for the national industries, with all the legal requirements and limitations, that those products can only be manufactured or produced by the national company. So, if the purpose is competitiveness and modernization, why don't the leading manufacturers legally establish companies that would develop those products, even though they already have that technological mastery abroad for application on the assembly lines? Now, national companies, I think it's Vertice, have already developed electronic sensor systems with multiple uses, some already exportable, for an accessories line abroad. The technology for electronic injection is currently being developed in institutes for application to vehicles. Sooner or later, this will be a technology mastered in the country. Now I ask: Will that company, which maintains so much secrecy and imposition, adopt the product with national technology? Obviously not, because there is a vested interest in the existence of a certain lag, a technological 'gap,' a hiatus, to prevent the national (Brazilian) industry from ever becoming equipped to compete internationally. In other words, it must continue attempting to use technology that has already traversed the world, that already exists (...)."

As Jose Roberto Ferro commented: "Brazil was not competitive 10 years ago; it was not competitive 20 years ago; hence, there is nothing new about this statement. If we had been on the open market 10 or 20 years ago, the situation would be more or less the same" (meeting of 25-6-91).

There can be no credence in the dissemination of technologies in the "form of assistance," or "manufacturing license." It is a process limiting creativity, in traditional technologies, such as mechanics, and even more so in leading edge sectors. "The technology has a segment, an essential pre-condition, which is mind-set. An awareness must be created of the importance of technology in the industrial process" (meeting of 25-6-91).

In good conscience, one does not discern in the automotive spectrum any change for the better in the scenario (unless more genuinely national companies are created, or there is an appreciable expansion in the only existing one).

There are internal problems or external complications preventing the competitiveness of the producers or assembly lines installed here.

As internal factors, the deponents cited an excessive tax burden, both direct and indirect, indirect costs affecting salaries, a perverse inflationary and exchange crisis, low productivity, and the lack of an economy of scale that would make the vehicles produced here competitive.

As external causes, the international markets' distribution policies, the "trademark" problem, the patent interest, so that the branch-product will never be equal to the parent firm-product (therein lies the failure of the world car), the existing technological intercommunication, and, most importantly, the decision-making power that is non-existent in the installation of assembly lines in Brazil, are cited. Thus, the automotive sector will have to maintain a staff of human resources only sufficient to lend continuity to its local activities, and to supply the domestic market, in a configuration of second-rate technological products (technology already used by the world) that is strongly cartelized.

3.4.1 - Conclusion

One does not discern integration or a major addition of critical mass, although it is available in the universities and development centers, because this is not the desire of the sector's entrepreneurs.

3.5 - Industrial property

3.5.1 - Industrial protection: the Brazilian situation

Legal protection of industrial property must be analyzed:

1) as part of the nation's reality; and, 2) in conjunction with the other protective devices that have worked in favor of business firms capable of generating technological progress, or against them.

The contribution from the multinational companies installed in Brazil has been negligible in terms of internal research and development activities and in terms of demand, as users, for technologies produced outside Brazil.

Hence, it is fitting to make a distinction, in the general context of industrial protection, between the situation of those companies and that of national companies.

Through the policy of the national counterpart, there was moderate protection for machinery and equipment industries. High tariff barriers and others guaranteed protection of durable consumer goods. In both instances, the protection benefited national and multinational companies alike.

However, this is by no means an indication that those two types of companies competed with each other or, when they competed, were on an equal footing. This is because the advantages and subsidies favoring the multinationals were incomparably greater. It is surprising that the present government is adopting many initiatives to increase the benefits for the very business firms that concentrate their strategic and technological activities abroad.

The multinationals have the following margins of protection in comparison with locally controlled companies:

a) they use technology developed in the parent firms, paid for with the sales made on larger sized markets abroad;

b) they also have access to machinery and equipment in which those technologies are built in, for the importing of which they have tax benefits, import duty exemptions, and sometimes exchange benefits (the latter benefits apply to national firms only if they have access to machinery and equipment and other conditions for entry into the market);

c) financing at international prices. The latter has represented a maximum of 5 percent annually in real interest, whereas local companies have paid real annual interest of from 50 to 200 percent.

Moreover, when the restrictive practices of multinational companies with an oligopolic hold on technology impede access to it by national companies, the latter have to develop their own technologies. They are also burdened by the financing costs and scales far lower than those of the products developed in the main countries. And the multinationals also have in their countries of origin sizable subsidies for their research and development: The chief mechanisms for this are government purchases and large non-reimbursable investments by research institutions with public funds.

Several deponents provided information on those subsidies. In the U.S., with the world's largest GDP, and with one of the highest investments in R&D with respect to GDP, nearly half of that investment is defrayed by the state, although 72 percent is made in the companies. This means that 22 percent consists of public funds applied by private business firms. A few decades ago, 90 percent of the funds came from the government, i.e., 30 to 40 percent was passed on to the companies (Kurt Politzer, 5-8-91). The same deponent claimed that, in Japan, the state provided an average of $26 billion annually, for a long time, to its small and medium enterprises, for new developments. In Germany, the state came up with 47 percent of the total investment in R&D, and no less than 68 percent of those funds was allocated to business firms (32 percent of the total).

The Federal Executive Branch has, through bills and MP [presidential orders] converted into laws, and by decrees and other acts, caused an even greater increase in the vast disproportion of benefits and subsidies in favor of the multinationals. With the same effect, it has proposed, through PL No. 824/91, an industrial property code to reinforce patent protection where it already exists, and to include in it foods, fine chemical products, and pharmaceuticals, as well as biotechnology.

The patent protection benefits foreign companies to the detriment of the national ones. As was noted by Ubirajara Cabral (13-8-91), 99 percent of the orders placed with the INPI [National Institute of Industrial Property] are from foreign firms, and 85 percent of the patents granted in Brazil have been in favor of persons residing abroad. Obviously, under the market conditions and with the commercial and industrial policies in effect, there is no chance, unless as an exception, for Brazilian business firms to develop technology. The entry of patents worsens the situation further, although it was already deplorable. In short, the foxes are being given more sophisticated hunting equipment, and the chickens' wings are being clipped. After all, our companies are chickens, and not foxes.

3.5.2 - Bases for protection of industrial property

Patents are a device for market reserve (Ubirajara Cabral, 13-8-91), a monopoly, against the public interest. Hence, they are only justified if granted for a short time, and insofar as they can stimulate the development of new technologies. The privilege of the patent will foster that development only abroad, in the very countries where the governments themselves are already aiding it in various significant ways. It is clear that, in Brazil, patent protection should be more tenuous than that established in 1971, and should not be increased. After all, the development protected by patents is not ours.

Moreover, there is every indication that the increased reinforcement of patents throughout the world, in the context of an international economic order imposed by a minority of central cores of world power, does not benefit technological progress, even in the majority of the developed countries themselves. It is, primarily, a tool for supporting internationalization of the economy, under the control of an increasingly smaller number of large multinationals, almost all located in just three or four countries. Even in those countries, for patents to be a factor for impelling technological development, the safeguards would have to be more extensive and intensive. And some, less well informed, propose in Brazil more extensive patents and weaker safeguards than exist in the developed countries.

The Executive Branch's proposal, and even much of what is included in alternative bills, implies greater restrictions on the already virtually impracticable transfer of technology. One of the deponents (Mauro Arruda, 13-8-91) explained that, at the time of the substitution of imports, the capital concentration was less, and the practices restricting transfer of technology were less intense than they are today. They were increased based on the new industrial pattern starting in the mid-1970's, impelled by informatics, microelectronics, and other leading edge industries. He claimed that the oligopolies have succeeded in excluding newcomers, and that the technology contracts have ceased to be a viable means of achieving this.

The restrictive practices stemmed from the companies' interest in maintaining their oligopolies. Only to a lesser extent were they prompted by government policies in their countries. An example is COCOM, which prevented sales of technology and products with a high degree of technology incorporated to Eastern countries and others, based on the aforementioned strategic considerations. At present, the bans on exports are affecting mainly the ex-developing (third world) countries, and becoming more extensive and frequent, mainly because nearly all the technology could be converted from civilian to military use, or vice versa. In this connection, the same deponent (Mauro Arruda, 13-8-91) cited a report from the OECD [Organization for Economic Cooperation and Development] itself, calling for an intensification of technological neo-mercantilism, applied according to the criteria of the North.

Moreover, in some instances the multinationals prefer not to patent the technologies that they have, using secrecy as a main protection. And, when there is patenting, it is more often to prevent competition than to favor the application of new technologies to production. As indicated by Ubirajara Cabral, only an average of 12 percent of the patents registered have been exploited, 25 percent being in the pharmaceutical industry (13-8-91).

The same deponent also observed that there was never so much foreign investment in Brazil as during the 1970's, a time when the present law was already in force. A similar comment was made by Kurt Politzer (5-8-91): The amendments proposed in the patent legislation prompted an increase in the outflow of foreign capital.

Those proposals are perverse in two ways: 1) by giving a privilege in local production to foreign enterprise, to the detriment of the national enterprise, which means virtually eliminating any development of technology in Brazil's private sector (while the state sector is simultaneously being liquidated); 2) by giving the market reserve to foreign companies, benefiting imports to the detriment of local production, in the same direction as the industrial and commercial policies that are under way.

It should be noted that the second point relates to production of the good that uses the technology, something of less value, and not to production of technology, which is strategic. As will be demonstrated later, that legislative proposal awards even the monopoly on import to the patent-holding company; and the multinationals will prefer to import rather than produce in the country, because by so doing they will not have to make any investments (see U. Cabral, 13-9-91, and K. Politzer, 5-8-91).

3.5.3 - Explanation of the inexplicable: pressure

Many deponents mentioned the pressure from foreign governments, international organizations, and "lobbies." That pressure is leading to an endless series of concessions by the Brazilian Government, with nothing in return. The analysis of the facts shows that there is no rational explanation, from the standpoint of the country's interests, for the policies in progress, particularly for those that the government wants to establish for industrial property.

Ubirajara Cabral (13-8-91) gave a reminder that 25 percent of the exports from the U.S. are linked to that property (patents, trademarks, copyrights). Cabral, Mauro Arruda, and others pointed out that the deterioration in the U.S. balance of payments was at the bottom of the hardening of that country's commercial legislation, leading to the revisions in the Trade Act of 1984 and 1988 (M. Arruda, 23-8-91). The application of Section 301 of that U.S. law redounded in quotas and compensatory duties, which had a negative effect on the value of Brazilian exports. As was declared by authorities in that country, some sanctions were suspended, on the condition that amendments in the industrial property law would be approved in Brazil. The president of the CPMI, Senator Mario Covas, noted as improper interventions in our internal affairs the positions assumed by the U.S. vice president and other foreign authorities during a visit to the country.

As was noted by K. Politzer (5-8-91), the so-called retaliations violate the United Nations Charter on Rights and Obligations, and the General Agreement on Tariffs and Trade (GATT). An attempt has been made to apply a national legislation to other countries, and Brazil should have recourse to international forums (idem).

3.5.4 - The absurdity of free concessions

Several deponents expressed their dissatisfaction at the concessions given with nothing in return. Some, like Ney Bittencourt of Agroceres (6-8-91), and Adib Jatene (9-9-91), think that, concurrently with the safeguards required by the patent legislation per se, they should be given only in exchange for the elimination of restrictions on Brazilian exports. In a similar vein, J. Diniz de Souza (13-8-91) termed it absurd that Brazil should grant advantages without negotiating barriers to our products with the European Community and import quotas with the U.S. He described the already consummated decree of zero quotas on Brazilian imports without reciprocity as betrayal of the country. Too much has already been granted in this respect, and the proposed code on industrial property is another free concession. Nelson Brasil (Abifina) expressed his regret over the free surrender of the internal market because, to concede in that area, changes should have been obtained in the rules on the foreign debt and the release of trade barriers (6-8-91).

Mauro Arruda (13-8-91) also indicated the absurdity of conceding even on points still being debated in GATT and the WIPO (World Industrial Property Organization). Ubirajara Cabral (13-8-91) gave a reminder that the Paris Convention of 1883 does not bind any country to one patent system or another, and that 60 countries have not adopted them. Finally, Senator Mario Covas did not regard as a valid reason to consider a legislation the mere fact that it is viewed as inevitable, based on the pressure in favor of it.

3.5.5 - Proposals

There are other factors making the Brazilian economy and technology impracticable, regardless of the treatment given to patents. Jose Diniz de Souza cited the industrial and commercial policies (13-8-91). Mauro Arruda observed that the pharmaceutical sector has not developed significantly, even without being hampered by patents, because it lacked the support given to other sectors, with tax incentives, priority financing in the BNDES [National Bank for Economic and Social Development], etc. (13-8-91). Nelson Brasil remarked that all the industrial sectors not directed toward the international market are being paralyzed, even without the amendments in the patent law (6-8-91). Kurt Politzer makes seven suggestions in favor of technological development not related to industrial property.

Nevertheless, all of them admit the importance of a suitable patent legislation. Furthermore, the consensus was that the Executive Branch's proposal is detrimental to the country's technological development. Most of the deponents were opposed to the inclusion of the sectors currently excluded in the patent protection. Some deem the instrument valid, even for those sectors or for some segments of them, provided that it is adopted with safeguards in

keeping with the country's economic phase. There were some who, although considering the inclusion of new sectors in the patents unadvisable, accepted it, because it was politically inevitable, converging for the defense of those safeguards.

Thus, a position even more firmly opposed to the expansion of patent protection and more strongly in favor of safeguards is justified. The truth is that the facts and arguments put forth by the deponents, when analyzed together, lead to more solid conclusions than could have been reached separately during the meetings.

3.5.6 - Segments with special treatment

3.5.6.1 - Biotechnology

The vast majority of deponents expressed disapproval for the inclusion of biotechnology in the patent protection system. Dante Alario Jr., of Alanac, stressed that this inclusion, detrimental to fine chemistry and the pharmaceutical industry, is especially so for biotechnology. The U.S. patent law does not cover modified microorganisms, although in some instances the Supreme Court has allowed them. In Western Europe as a whole, patents are not recognized in that field, and most of the developed countries are reluctant to legislate in this regard before the implications of the new technologies become better known.

Pinheiro Machado, of the UFSC [Federal University of Santa Catarina], also submitted arguments for the exclusion of that segment. He noted that there had been theft of natural species from various Brazilian regions, which were later subjected to genetic changes and introduced with high-sounding names. The patent would also impede the use of our own natural species. He added that Brazil, with its investments in research obstructed, is equipped to produce very few discoveries tested in laboratories, compared with the developed countries. In this respect, the patents would protect only the developed countries, with but minimal exceptions. As for the results of computer simulations of changes in molecular structure, an area in which we are equipped to advance, we shall be impeded if we recognize patents (6-8-91).

Kurt Politzer assumed a position in the same direction, noting that the patenting of compounds existing in the human organism would create an absolute monopoly (5-8-91). Nelson Brasil, of Abifina, also demonstrated that patent protection in biotechnology would not serve the country's interests.

Arguing against the position of Guilherme Emrich, of Abrabi and Biobras (6-8-91), Nelson Brasil indicated that this company's success with insulin is an exception, because there is virtually no biotechnology industry in the country (6-8-91). Such cases could be protected, allowing a product patent, with safeguards, but never one for the process. He also claimed that, if patents are allowed in biotechnology, the multinationals will arrive with orders based on results of computer simulations, rather than development in a laboratory, taking up space during the two to three years spent evaluating the orders.

The Embrapa president, Murilo X. Flores, explaining that this state company's position is still being studied, expressed the view that biotechnological processes and products ought to be patented (6-8-91). It should be noted that this deponent, holding a position for which he was selected by the Executive Branch, could not assume a stance against that authority's proposal.

3.5.6.2 - Agricultural products

Murilo X. Flores, of Embrapa, argued that, to protect varieties of plants, the improver's rights adopted by the International Union for Protection of Plant Species should be used, thus rejecting patents (6-8-91). The improver's rights should include continued use of second-generation seeds of registered varieties, as well as those of varieties registered in programs for improvement of new cultivations.

Ney B. de Araujo, of Agroceres, thinks that, in the case of cross-pollinization plants, which have a decline in productivity starting in the second generation (hybrids), industrial or intellectual protection is unnecessary. In the case of autogamous plants, such as soybeans and others, which retain their genetic identity after being improved, the improver's right should be applied, like the copyright (6-8-91).

3.5.7 - Safeguards

3.5.7.1 - Waiting period

If patents are adopted, various safeguards must be ensured. In the opinion of the vast majority of deponents, the first is that such protection (in fact, given only to foreign companies) should go into effect only after a period required for adaptation and investments to compensate for the lag in research and technology. It must be understood that the waiting period makes sense only if there is a change in the whole group of policies leading to a greater lag rather than compensating for it. If this is not done, if any logic remains, it should lead to non-acceptance of patents.

Several deponents demonstrated that, in the developed countries themselves, patents have only been expanded and applied to special sectors, such as fine chemistry and the pharmaceutical industry, after those countries had long since achieved expertise. During that period, they a) invested heavily in R&D; b) gave incentives to local companies with state purchases and other types of support; and, c) expanded the respective domestic markets, making suitable scales practicable. Nelson Brasil (6-8-91) gave a reminder that: 1) Italy and Switzerland remained without patents in those areas for 94 years, and Japan, for 77 years (in those countries patents were generally adopted at the end of the 1970's); 2) Canada has not recognized them to date; and, 3) in 1919, when Great Britain was a world industrial leader, it found itself non-competitive in the chemical industry, and stopped recognizing patents in the sector. It did not adopt them again until 1949, after having taken advantage of German patents expropriated as a result of World War II. Great Britain has an entire special system, which will be discussed under the topic of mandatory licensing.

With regard to fine chemistry and the pharmaceutical industry, the same deponent noted that the 10-year waiting

period for processes and 15 years for products, suggested by some organizations, including Abifina, is insufficient. He claimed to prefer that there be no patents in the sector; adding that, if they were established, the waiting periods should be longer than those intervals.

He suggested that the period exceed 12 years, since that is the average development time in the U.S., when there is adequate infrastructure (5-8-91).

Deputy Luiz Henriquez advocated periods of from nine to 10 years, but associated with the patenting of the product together with the process. This could prevent monopoly if the development of the same product through a different process is excluded from the patent (13-8-91). Jose Diniz de Souza, from Eletrometal, considers 15 years the minimal acceptable period (13-8-91).

3.5.7.2 - Validity period

The deponents considered the extension of the patent validity period from the 15 years in the present law to 20 years after the filing of the application to be unwarranted. In Japan itself, currently a technological leader in various sectors, the period is 15 years (Dante Alario Jr., 5-8-91). Ubirajara Cabral, ex-director of the INPI, considers the Executive Branch's proposal, exceeding what is done by the developed countries' governments in the defense of their business firms, to be absurd as well (13-8-91). Cabral also thinks that the period should be shortened rather than lengthened.

Similarly, other deponents showed that the period in the present law is overly long, considering the interests of consumers and those of maintaining some production in the country. Businessman J. Diniz de Souza, despite having developed important technologies, believes that this period should be far shorter. The deponent did not mention numbers, accepting eight to 10 years. This suggestion could be combined with that for mandatory licensing after two to three years, also made by Diniz (13-8-91).

Infantose, from COPPE, recommended the adoption of an application filing institution, assigned to prove within two years the potential for industrialization, with the expiration of protection in the absence of such proof (9-9-91).

In fine chemistry, the shortening of the period is essential for making the production of pharmaceuticals essential to the health sector viable. Only in this way will it be possible to reproduce generic products technologically, within a reasonable time after the expiration of the registration of patents associated with a certain brand.

3.5.7.3 - Compensation for privilege

Since the patent is a privilege, consisting of the granting of a monopoly, it is inconceivable without compensation for the society. The two principal types are: a) dissemination of knowledge associated with the object of the patent, through a detailed description of the process and the product; b) mandatory licensing, if the object of the patent was not exploited by its holder. Several deponents indicated the contingent nature that the patent institution should have. They include Kurt Politzer (5-8-91): a) publicize what is being done, so that the technology will continue to progress; b) apply the innovation in the country in which the patent was registered. This is also mentioned by Nelson Brasil (6-8-91).

3.5.7.3.1 - Detailed description

This requirement is, therefore, an indispensable requisite for the existence of patents. If approved, the new law should include it, based on the more demanding standards adopted in other countries, or at least maintain those in the law currently in force. The deponents (for example, Dante Alario Jr., 5-8-91) claimed that Bill [PL] No. 824 unjustifiably eases the requirements on openness of information in the present law.

3.5.7.3.2 - Mandatory licensing

The purpose of the patents should be to give a reward to inventors and others investing in R&D, in order to encourage technological progress. Part of its "rationale" is not only that the privilege must be provisional, but also that it must contribute effectively to that progress, with the invention applied to production. Otherwise, the invention could even forstall that progress, as well as harming the economy of the nation, which ceases to produce and use the good that is protected. Competitiveness is unjustly sacrified, as is the population's standard of living. And, if those consequences apply to countries obtaining nearly all the world's patents, they should therefore apply even more to those also granting the privilege without receiving any of the benefits in return.

The provisions in the PL proposed by the Executive Branch disregard those realities. As noted by Ubirajara Cabral (13-8-91), that PL, in Article 73, paragraph 2, admits that importing may be an effective form of exploitation. Such a ruling would completely deflate the mandatory license, and hence, deprive production in Brazil of a good that is patented abroad, inasmuch as it has been imported. This is becoming the most attractive alternative for the multinational companies, because it does not entail any investment in the country.

And, to make the privilege even more absolute and more contrary to the national interests, the aforementioned PL, in Article 53, also confers on the patent holder the right to prevent third parties from: manufacturing, using, selling, marketing, purchasing, offering, importing, exporting, or stocking products that are patented (Ubirajara Cabral, 13-8-91). Among other monopolies, there is the one for exclusive import, also making it possible to by-pass the license obligation, without producing the good in the country. And, with the import monopoly, the multinational holding the patent is regulating the price and the domestic market, according to its whim and self-interest.

Kurt Politzer also demonstrated the unsuitability of the Executive Branch's PL, equating effective exploitation of the patent with importing, when the holder proves that production would be uneconomical (5-8-91). As the deponent noted, this idea is extremely subjective; and, furthermore, it is more economical for the multinational to make use of the facilities

that it already has in countries with a larger market than to invest in production in Brazil. If there were a mandatory license, which PL No. 824 virtually eliminates, the patent holder could still continue to export in competition with the local product. Dante Alario also expressed his chagrin at the virtual abolishment of the non-voluntary license in the Executive Branch's PL (5-8, Doc. 4).

In a similar vein, Guilherme Emrich, of Biobras (6-8-91) claimed it to be essential that the mandatory license be established for products not manufactured in the country, and that privileges not be granted for products already patented (non-retroactivity). Only those measures would guarantee that the multinationals will not close their industrial production in Brazil, and will not start importing end products from their parent companies.

Jose Diniz de Souza claimed that, if the patented good is not exploited two or three years after the privilege has been granted, a mandatory license should be given to anyone equipped to produce the good (13-8-91).

Kurt Politzer discussed the advantage of pursuing a course of action cited in the British patent legislation, wherein the patent for innovation and the patent for introduction were adopted a long time ago. Recognition was given for a patent obtained in another country, but whoever introduced the production into Great Britain also was entitled to a patent (5-8-91).

3.5.7.4 - Non-retroactivity

Several deponents pointed out that it was essential for the legislation not to apply to protection of those patents registered in their countries of origin before the new law goes into effect. On this point, as in so many others already noted, the Executive Branch's PL runs counter to Brazilian interests. As Ubirajara Cabral (13-8-91) shows, Article 217 of that PL makes protection of patents retroactive. He also demonstrates that the conditions stipulated in the bill for granting retroactive protection are very easy to meet, even if they are interpreted as cumulative. From the standpoint of the PL, this implies extending the privilege 20 years from the filing time to technologies patented abroad, even if they are old. Monopolies would be given for more than 15 or 20 years to holders of processes already in the public domain in the countries of origin.

Guilherme Emrich also claimed it to be essential not to grant retroactive protection (6-8-91). The same assertion was made by Dante Alario Jr. (5-8-91) and other deponents.

3.5.7.5 - Restrictive practices

Another flaw in the Executive Branch's PL, detrimental to the country, lies in the lack of a ban on restrictive practices and/or measures to discourage and reduce them. The gap was cited by Mauro Arruda (13-8-91). These practices are common in the activities of multinational companies, contributing largely to making transfers of technology even more scarce.

They cause most of the contracts for technology to relate more to its use than to the possibility of assimilating it. Furthermore, such practices make the terms of the contract, which are at times prohibitive, too burdensome for the less developed part of the country.

3.5.7.6 - Remittances and result

The present industrial property law does not allow foreign currency remittances from multinational subsidiaries to parent companies by way of "royalties" and other forms of payment for technology. They are circumventing the ban, making transfers through technical assistance, using official facilities for that type of remittance. Mauro Arruda informed the CPMI (13-8-91) that an amendment is being made to Law No. 4,131, on foreign investments, to make those intra-company payments for technology remittable, but not deductible.

The eagerness of the present Executive Branch, and of segments of other areas, to make openings of all types and to go overboard in granting privileges to foreign capital, is supposedly intended to attract it. But, in fact, this is not the case: Investment is made only where the markets are growing, and where salaries are not doomed to decline indefinitely. So, the avalanche of openings and concessions recalls one of Groucho Marx's jokes, because the multinationals behave like the one who says: "I wouldn't join a club that accepted me as a member."

3.6 - Telecommunications

Since the invention of the telegraph, telecommunications has been acquiring ever growing importance.

Just imagine the impact that the opening of the first submarine cable linking Brazil with Europe, in 1874, had on the Brazilian population. Used to waiting weeks for news carried by ships, the population began learning about events, if not immediately, at least from the next day's newspapers.

The changes quickened with the invention of the telephone, the wireless telegraph, radio, the automatic telephone exchange, television, satellite communications, the use of telecommunications to convey data, etc.

All this converted the telecommunications sector into a vital one for nations, not only from an economic standpoint, but also in all the other areas of human society's life.

Based on these premises, the CPMI decided to investigate Brazil's technological lag in telecommunications, especially in the telephony, telex, and data communications sector, operated in Brazil basically by the Telebras System - STB. This does not mean that the Commission failed to consider radio sound, or sound and image broadcasting, because the two parts are closing linked. But the emphasis has been placed on the STB complex.

In this country the telecommunications sector, excluding radio broadcasting, employs nearly 180,000 persons directly, with a billing of nearly $8 billion, or about two percent of the GDP (Mauro Porto, 26-8-91).

The Brazilian Telecommunications Code, Law No. 4,117 of 27 August 1962, was the initial framework for a process which, at a given time, endowed Brazil with an exemplary

telecommunications system for a third world country. However, the lack of continuity in investment and a rate policy that has kept rates extremely unbalanced in recent years, far below those of the international parameters (Allen Habert, 26-8 91), jeopardized this conquest.

Hence, the Brazilian telecommunications system has observed its performance worsen in nearly all the quality control indexes maintained by the system, such as the national percentage of busy conditions in DDD [direct distance dialing] calls. In 1990 it was 25 percent, whereas the desirable percentage is somewhat less than 5. Also, at the end of 1991 nearly a million telephones had been sold and not installed, many of which were sold over 24 months previous.

The investments that enabled Brazil to create a moderate telecommunications system originated basically in two sources: the National Telecommunications Fund - FNT, and self-financing of telephones. However, before it became defunct, during its last years (1986-88), the FNT had its funds totally absorbed by the National Treasury, without any investment in telecommunications. During the previous years, only a portion could be applied to telecommunications (Hercules Gissi, 26-8-91).

As for self-financing, it is clearly a system that has become depleted owing to the reduction in its universe of users, since not everyone desiring a telephone who can pay the rate is able to cope with self-financing costs.

Moreover, it distorts the rate structure: in other words, by charging a self-financing amount for entry into the system, an indirect rate is charged in advance; because the shares given to the user in return have a value far lower than the self-financing (Mauro Porto, 26-8-91).

The rate, which would allow the STB to maintain constant investments, has undergone increasingly larger imbalances, to the point where it is now a quarter of what it was in 1972. This has caused, among other distortions, 20 telephone jacks to be required to make up the price of a cup of coffee (Allen Habert, 26-8-91). The low rate has ended up subsidizing the present telephone holders (Allen Habert, 26-8-91), to the detriment of those who, lacking one, or desiring one, are unable to obtain it owing to the sector's lack of investment capacity. They obtain one only on the parallel market, at often exorbitant prices.

The present situation has converted Brazil into a country where the telephone is an investment, and what is worse, a speculative investment. Investing in a telephone has ended up being better than investing in real estate: it appreciates more, the leasing is longer, and there are no upkeep expenses. This is a serious deviation from what should have been only a public service provided to all those desiring it, who should pay only the installation fee in order to obtain it.

As a result of this entire situation, at the end of 1990 Brazil had 10 million installed telephones, representing nearly 7.0 telephones per 100 inhabitants. Meanwhile, Great Britain had 51, Portugal, 16, Argentina, 9.2, and Mexico, 8. The repressed demand is difficult to calculate, both because of the existence of self-financing and the large number of telephones sold and not installed by the system; as well as the fact that the telephone has become an investment. However, it may be conjectured that, if the telephone became a service to be provided, compensated by the rate, and the cost of entering the system were only the installation fee, the immediate demand would be 100 percent of the telephones currently installed. This shows the deficiency of the country's telecommunications system, and how much investment will be required to put it on a sound footing. At a cost of nearly $4,000 (price of the terminal installed by the Telebras System, 1991), there are investments of $40 billion (Notes on Technological Policy of the Association of CPqD Officials, No. 4, June 1991, p. 5, distributed by the deponent Allen Habert).

Having established this picture of the telecommunications situation in the country, the Commission, in its activities, especially at the round-table discussion of 26-8-91, attempted to investigate the technological problem associated with it. And since, when telecommunications technology is discussed in Brazil, one discusses the Telebras Research and Development Center - CPqD, located in Campinas, the Commission attempted to analyze, primarily, that center's activity, the developments achieved, and the directions of its future activity.

The CPqD, founded on 31 August 1976, had, from its beginnings, the mission of creating a national technology of its own, "based on the requirements of the national telecommunications system and the nation's intrinsic interests" (Leoncio V.R. Neto, 26-8-91).

Although it was also aimed at "creating suitable conditions for absorbing and installing foreign technology," it is not a model conceived to substitute for imports, as its Superintendent-Director declared in his deposition to the CPMI (Leoncio V.R. Neto, 26-8-91). This is because, owing to various projects, and particularly in the case of the Tropical Exchanges project, the research and development occurred simultaneously with that abroad. The CPqD developed the CPA-t Exchange (Stored Programming Exchange, a temporary matrix, which is the current state of the art for a telephone switchboard exchange), the most modern in the world, at lower cost (Allen Habert, 26-8-91).

It should be stressed that only eight countries have succeeded in developing this type of exchange. When all the costs are computed, the CPqD spent $250 million to develop the Tropical Exchange. Ericsson of Sweden, the one spending the least after CPqD, paid $500 million; and Great Britain (Gec/Plessey), $1.4 billion (Allen Habert, 26-8-91).

The Tropical Exchange is the most modern of the existing CPA-t, because its processing is accomplished through a distributed system, with hundreds of microprocessors operating in a decentralized manner. In the event of a failure, only one or a few microprocessors are left out of operation. It is what is called "soft degradation." Ericsson's AXE Exchange, for example, operates with two central processing units. In the event of a failure, the breakdown is far more serious.

The importance of the CPqD may be underscored by 76 different products (besides the Tropical Exchange, its principal development), the technology for which has been transferred to 70 industries to date (Leoncio V.R. Neto, 26-8-91).

The CPqD is a model that integrates the university (many of its developments, such as fiber optics, originated in the university and were later taken over by the Center) with the equipment producing industries. The CPqD is the "interface" between the universities and the industry, although it does a large volume of its own research. It is a model with proven success in integration between university research and industry.

The CPqD's results for the country, and particularly for the STB, are unequivocal. In terms of prices of equipment acquired by the STB after equipment developed by the CPqD entered the market, the following performance was observed:

- MCP-80 multiplexer - prices drop nearly half; - CENTREX Exchange - prices drop nearly half; - COMPAC Exchange - prices drop nearly a quarter; - RA Tropical Exchange - prices drop nearly a third.

In the case of the RA Tropical Exchange, the average price per telephone terminal, counting only the price of the Exchange charged by the multinationals operating in the field in Brazil (basically, Ericsson, NEC, and Siemens), was nearly $1,000 per terminal. It dropped to approximately $330 after the marketing of the RA Tropical began (Leoncio V.R. Neto, 26-8-91). This means that, with the installation of 500,000 telephones, which is STB's annual average, and a savings of $600 per telephone, the exchange's development has been paid for in less than a year.

These price reductions have been viewed extremely positively, as they were by the deponents at the round-table discussion on telecommunications held on 26-8-91.

The CPMI, however, based on everything that it learned in this regard concerning both telecommunications and national technological developments in other sectors, made a different assessment.

Considering the case of the telephone exchanges, before the arrival of the RA Tropical Exchange the multinationals were, basically, Ericsson, NEC, and Siemens, operating in Brazil associated with national groups. The average prices of their products, per telephone terminal, and counting only the Exchange cost, were $800 (Dec 87), $950 (Dec 88), and $1,100 (Dec 89). They dropped to nearly $330 during the first half of 1991, after the RA Tropical Exchange began to be offered in the STB's bidding competitions, in July 1990, by the four manufacturers to whom the technology was passed on by the CPqD: Promon, Elebra [Brazilian Electronics], STC, and Sesa (Leoncio V.R. Neto, 26-8-91).

Such a precipitous and sharp drop in prices is something frightening to anyone. Two things could have happened: First, the three aforementioned multinational suppliers were charging unfair prices before the arrival of the RA Tropical Exchange; or, they were engaged in "dumping" aimed against the national companies manufacturing the RA Tropical Exchange, after its offer in the STB bidding competitions. It is most likely that a combination of the two possibilities occurred: that is, the prices were previously unfair, as well as excessively low (in other words, "dumping" was practiced after the RA Tropical Exchange's entry on the market).

The same reasoning applies to the other products mentioned, which had an abrupt drop in prices after they were offered on the market by the manufacturers to whom the technology had been passed on by the CPqD.

It is well known that when any product resulting from a recent and important technological development enters the market, its price is initially set so as to pay the costs of the investment made and to allow its manufacturer to accumulate funds to continue its development, which must be continuous. Without this, the product loses the market to other competitors who have become technologically improved. It is an acknowledged fact that "the technological issue has no solution apart from the market, which is the only source of real stimulation for investment, research, and development; because the rest, exemptions, assistance, and direct government investment, can only be a useful and welcome complement" (Mauro Porto, 26-8-91).

This price decline that occurred clearly reveals the multinational companies' strategy of impeding the technological development and growth of the RA Tropical Exchange. By bringing prices abruptly down, the multinationals, although they might operate with losses over the short term, were really throwing away a competitive product in the medium term. They were preventing national manufacturers from capitalizing, and, by capitalizing, becoming able to develop the RA Tropical Exchange. Finally, the RA Tropical Exchange has proven to be a major development, with a great potential for growth, not only on the national level, but also on the world market. To halt this development, by "dumping," is a strategy of the aforementioned multinationals that has become quite clear from the analysis of the abrupt, unfair drop in prices that occurred.

And what has been observed is that there has been no initiative on the government's part to investigate the matter and adopt the necessary precautionary measures. On the contrary, when the decision was made to develop the CPA-t, the then Communications Ministry, through Administrative Directive No. 661 of 1975, stipulated that, when the CPA-t technology became available, it would be the only one accepted by the Telebras System: in other words, only RA Tropical Exchanges would be purchased. Subsequently, through Administrative Directive No. 215, of 1981, that Ministry stipulated that the reserve guarantee would be 50 percent. And when the RA Tropical Exchange began to be offered on the market, it no longer had any protection, and had to compete directly with the others with foreign technology, lacking any policy established by the government to give an incentive to national technology.

It should be stressed that, in this instance, it is not a matter of investing heavily to develop a national technology. It is

only a matter of creating conditions to allow a leading edge technology developed in the country, of first-rate quality and significance, developed by only eight countries, with an enormous potential, to grow through a market.

Since the STB is state-owned, it would suffice merely to use the state's purchasing power to allow for this growth. That expedient is called for in all the government's industrial development plans. However, when an actual instance appears, a case of crucial importance, the government fails to apply the expedient specified.

The consequences will be that the RA Tropical Exchange, unable to occupy a greater space on the market, will lack the capacity to have its development continued as it should, either by the CPqD or by the other industries to which the technology was passed on. The principal developments that can already be specified are those that would enable the RA Tropical Exchange to become an RDSI - Integrated Services Digital Network exchange, initially narrow-band, and later wide-band. This would make it a single exchange for telephones, telex, fax, data, etc.; and, then in wide-band, for images (television) as well. Now, without winning its place on the market, the RA Tropical Exchange will lack this development on the necessary level and, within the next few years, will inevitably be dropped from the market, because of being obsolete. And the country will have lost another great opportunity. It will see a technology developed here, of the very first quality, and internationally state of the art lost, because of failure to apply protective mechanisms to national technology.

A situation similar to that of the RA Tropical Exchange is the one of fiber optics. The development plan was initiated in 1975 at Unicamp. During 1978 the project was taken on by the CPqD; and, in 1984, the technology was passed on to ABC XTAL for industrialization (Walter E.T. Machado, 26-8-91).

However, at a time when the STB is preparing its first major project with the use of optical fibers, the Embratel interconnection on the Rio-Sao Paulo route has been made so that the fiber optics technology developed by the CPqD could contribute a maximum of 30 percent of the total volume (Walter E.T. Machado, 26-8-91). And what is involved is only an increase of one or two units in the repeaters (of the 10 or 11 planned on the route); which would suffice to make national fiber optics viable without any loss of quality.

This is a matter of production scale. Whoever produces two million km of optical fiber, as only two or three international manufacturers do, can withhold from its production one or two percent of the optical fiber of excellent quality, meeting the STB's specifications. ABC XTAL, which produces "only" 80,000 km/year, does not have that potential (Walter E.T. Machado, 26-8-91).

Now it has been learned that Telebras, after having invested heavily in the development of the national fiber optics technology, is practically excluding it from its market.

But Telebras's CPqD is confronting other difficulties, worse than those already described in connection with the RA Tropical Exchange and fiber optics, because they entail its deflation over the short term, and could imply its closing over the medium term.

The first and major one is the "change in the CPqD model. From the model of import substitution, we now have competitive inclusion in the international market. And the key words in this new position are deregulation, competitiveness, productivity, and quality. Hence, it is in this context that the CPqD is changing its method of operation" (Leoncio V. Resende Neto, 26-8-91). Now it has already been questioned in this report whether the CPqD model should be a model for import substitution. Its two major developments were achieved at virtually the same time that they were abroad. The CP-t exchange and fiber optics were not available when the research was initiated, at the right time, bringing such extraordinary results.

But what exactly is the CPqD seeking with the change of model? "The direct transfer of the technological results to the Telebras System: results such as specifications, advice on the growth of the network, topology of networks, and architecture of systems." And there is a desire to abandon the previous system. "That outmoded model of the CPqD was preponderantly devoted to the transfer of technology directly to the industries in the sector...which, in turn, they produce and return to the Telebras System, selling the equipment" (Leoncio V. Resende Neto, 26-8-91).

The new model has already been installed. "Out of nearly 67 on-going projects, we decided to end about 40" (Leoncio V. Resende Neto, 26-8-91). In fact, 47, as the CPMI was informed during the visit that it paid to the CPqD.

So, the CPqD wants to cease being a research and development organ, and become merely a consulting organ for the STB. It is giving up a method of operation that has already produced spectacular developments, 77 of them passed on to industries, and is turning to consulting. It is becoming a de luxe consulting body, in view of its high level of qualifications.

The CPqD has also been suffering from a decline in the funds allocated to it. After it had received a contribution of $73 million in 1990, the prediction for 1991 was $60 million (Leoncio V. Resende Neto, 26-8-91). However, the amount obtained in 1991 would not reach $50 million. Add to this the lack of motivation among its staff of researchers, as the CPMI observed during its visit, resulting from the layoffs that occurred (Allen Habert, 26-8-91), the changes imposed on the model, and the the appointment of administrators dissociated from R&D (Leoncio V. Resende Neto, 26-8-91), and we shall have a picture of the deflation to which the CPqD is being subjected. Since it cannot be closed, because the reaction from the national scientific community would be enormous, it is being gradually deflated, so as to have a slow death.

This CPMI, which is investigating the causes and dimensions of the technological lag, could not remain silent when faced with the way in which one of the major entities for

technological development in Brazil, after having made so many conquests, is being managed.

This being the case, the deflation to which the CPqD is being subjected, after all that it has already accomplished in terms of technological conquests for this country, is something that the CPMI wants to point out to the nation, demanding that the Federal Government change its policy in this regard.

3.7 - Agrofood and agroindustrial complexes

The analysis of the so-called agrofood complex was based on the depositions and debates that took place during the CPMI meetings of 6-8-91 and 2-9-91. They had as respective topics: "Science and Technology in the Agrofood Complex and the Policies on Trademarks and Patents," and "Science and Technology in Agroindustry."

3.7.1 - Historical perspective and identification of the sector's present phase

The analysis of the recent evolution of Brazilian agriculture was presented based on two lines of thought. The first considers the modernization of the agricultural sector still insufficient, and attributes the technological lag to the imbalance when compared with the agriculture in the developed countries. This view stems from the depositions of Murilo Xavier Flores and Ney Bittencourt de Araujo. The second considers the movement to modernize agriculture an imposition to make it dependent on foreign technology, claiming that its adoption exacerbated the inequalities and imbalances in the use of production factors. That line regards the technological lag as a result of foreign domination and the lack of a national effort to surmount the technological challenges.

Its main characteristics were depicted by Luiz Carlos Pinheiro Machado.

Presented next are excerpts from the deposition of Murilo Flores and, subsequently, of Pinehiro Machdo, with their principal arguments.

From Murilo Xavier Flores:

"The history of Brazilian agriculture created two agricultural models: 'plantation' and subsistence agriculture. During recent decades, the first has been converted into 'agribusiness,' marked by intensive technological, commercial, and financial relations between agriculture-livestock and the industrial and services sectors. On the other hand, subsistence agriculture did not keep pace with that transformation process, showing major regional differences in the method of organizing production and with respect to its integration with the more dynamic branches of the economy.

"Modern agricultural property changed the structure, and is consuming increasingly less of what it is producing. The modern farmer is a specialist confined to cultivation and breeding operations. The functions of supplying modern components, storage, processing, and distributing foods and fibers will, in the long run, be transferred to organizations beyond the farm gate. A 'complex' of functions outside the farm was created, including the production of agricultural input and production factors, such as machines and tools, tractors, fuels, fertilizers, feed supplements, vaccines, medications, improved seeds, insecticides, herbicides, fungicides, and many other items, as well as banking services, agricultural insurance, research, technical assistance, and extension facilities.

"Downstream from the farm, structural complexes were formed for storage, transportation, processing, industrialization, and distribution which, in total value, exceed the combined value of the input used and the activities on the farm.

"In the United States, the agricultural sector within the farm constitutes only three percent of the gross domestic product, while the so-called agricultural-livestock complex, or 'agribusiness,' constitutes 17 percent of it."

This "complex" is defined as "the total sum of all the operations involving production and distribution of agricultural supplies; production operations on the farm; storage, processing, and distribution of agricultural products and the items produced with them." He goes on to say: "There, production on farms, discounting the cost of input, totals $150 billion. There, the sum of the final value, on the consumer level, of all products originating on farms amounts to $850 billion."

"As for employment, for every person active in American agriculture there are five others engaged in producing input, and providing services involved in the so-called food or agroindustrial chain.

"In Brazil, the value added of the agroindustrial complex is $140 billion, the country's largest business, distributed as follows:

"- 8 percent - input and services for agriculture;
- 32 percent - agricultural-livestock production as such;
- 60 percent - value added outside the farm gate.

"For every two cruzeiros, including input generated inside the farm, five cruzeiros are associated with the final consumption level.

"As for employment, Brazilian agriculture (this is 1987 information) employed 14 million persons; the industry and processing portion, nine million persons; and the commercial and marketing portion, 6.6 million persons. This totals nearly 30 million jobs, or approximately 50 percent of Brazil's economically active population.

"This year, the investment in research totals $350-400 million, with from $200 to $350 million related to the Embrapa budget.

"The developed countries spend between 2.5 and 3.5 percent of their GDP on S&T. The necessary minimum recommended by international agencies is one percent of the GDP, which would be $1.4 billion, or four times the total current investment. Of the current investment, 90 percent is associated with public sector spending."

Pinheiro Machado (6-8-91) stresses that the recent evolution of Brazilian agriculture has caused an environmental

deterioration. During the period 1964-79, the consumption of insecticides increased 233 percent; that of fungicides rose 584 percent; and that of herbicides reached 5,514 percent. According to the same deponent, the introduction of new techniques has occurred without any kind of testing or experimentation, or even adapation to local conditions. Hence, it could cause irreversible damage. According to the deponent, providing for the internal consumption of food is the priority function of agriculture; hence, great care should be taken in adopting technologies with a large use of input, because the ratio between the prices of input and those of the product has been causing the position of farmers producing for the domestic market to become highly unstable.

He illustrates this claim by using data from the FAO which, taking the index 100 for 1979, show that the average prices received by producers of all agricultural products in 1984 reached an index of 2,021. On the other hand, the index on prices paid by producers rose from 100 to 7,150 (tractors and machinery), 8,500 (fertilizers), 12,000 (pesticides), and 8,500 (seed); making an average of 8,000 for all input. Hence, there is a ratio four times greater at the end of the period. During the same interval, no increases were observed in physical productivity of food crops. Thus, one notes an unfavorable ratio of input price/product price for producers, with a resultant capital depletion among them and a transfer of funds outside of agriculture.

The government policy for the agricultural sector during the past three decades sought integration with the world productive system, and was responsible for dynamizing its production of exportable agricultural goods. Therefore, Brazilian agriculture had to be modernized.

The strategy pursued to carry out this modernization was supported by the Green Revolution budgets, entailing the massive use of modern input, as a means of heightening the physical productivity of the agricultural industry. What it was agreed to call "conserving modernization" began operating in agriculture. In other words, there was a group of policies which, without upsetting the land base, or even aggravating the concentration of landholding, would make agricultural production viable, integrating it into the process as both a consumer of industrial products and a supplier of raw material for the processing agroindustry (meeting of 6-8-91). The disparity was between the more constant features of the process and the rate of modernization.

The reports show that the modernization occurred with greater intensity in the agricultural areas of export farms. On the other hand, the modernization caused marked changes in labor relations, leading to a partial, precarious wage payment because of the seasonality and the expansion of monoculture in various parts of the country. Moreover, because of the high degree of input use, the sector became heavily dependent on the urban industrial sector and the introduction of raw material.

3.7.2 - The policy of trademarks and patents in agriculture

According to the Embrapa president's deposition, that company has been advising the Agriculture Ministry in the preparation of a bill for intellectual property for innovations in agriculture, including the following features:

1) The intellectual property relating to biotechnological processes and products would have to assume the form of a patent included in the new code on industrial protection;

2) The alternative of patent use to protect varieties (cultivations) of plants must be discarded in favor of an "improver's rights" type of protection, similar to that used by the International Union for Protection of Plant Species (UPOV);

3) The legislation to protect intellectual property involving plant varieties (cultivations), to be established, must allow the continued use by farmers of second generation (subsequent) seed of registered varieties (farmer-rights);

4) The protective legislation must also allow the free use of varieties registered in programs for improving new cultivations, both public and private;

5) Similarly, species or new breeds of animals do not constitute items entitled to receive any kind of protection.

Ney Bittencourt de Araujo fully identifies himself with Embrapa's own position, proposing the adoption of an improver's right legislation instead of a patent.

He claims: "The improver's right is something like a copyright, which is a system established over 30 years ago in Europe. This means the following: within a government-controlled general system, with representation by private enterprise, there is a system guranteeing the improver a 'royalty' right, every time the variety developed by him is used."

Pinheiro Machado is diametrically opposed to the adoption of patent recognition in biotechnology. He argues that genetic engineering has permitted the manipulation of live beings, making it possible to breed new organisms. If there is a limitation on the genetic potential of a plant, it becomes strategic to have full biodiversity, so as thereby to select desirable genetic characteristics.

Now, Brazil shows a fantastic biological diversity, primarily in the Amazon and Mato Grosso State lowlands regions.

Those plants have been taken out of the country and reintroduced after being improved. Should we pay "royalties" for them? An example of this is the "silver leaf" plants, which are the same desmodiums and stylosants that were taken from Brazil. Since the developed countries have identified the DNA sequences of most of the plants, that is, their genetic codes, the recognition of patents in biotechnology would establish a technological dependence on living organisms, whose major natural heritage is Brazilian.

In this connection, Deputy Irma Passoni (6-8-91) argued that, since Brazil is a signatory of the 1893 Treaty of Paris,

whereby it was agreed that countries are free to adopt patents for foods and medications or not, we should ask: what are the consequences of adopting patents for these products?

Murilo Flores gave the following response:

"First, based on the existing potential, it should be proposed that the alternative of using patents for the variety of plants be totally rejected.

"Second, after analyzing the two other options (seed law and UPOV type cultivation protection), the UPOV type protection is considered more beneficial. This procedure, without an immediate commitment to UPOV affiliation, will make it possible to protect cultivations already started in Brazil by public and private entities. There would be a minimum period of one year to request protection for the already started cultivations, both by public and private entities: that is, a way of protecting the genetic 'pull' already adapted and in use. Another important point: the system should consider non-protection, including that of the essentially derived varieties (and this is important) obtained by retro-crossbreeding, mutation (natural or artificial), variation, clonal soma, transformation by genetic engineering, and selection of a variation. In this case, the protection of the original variety remains, and there can be no protection for those essentially derived and those not clearly distinguishable from a protected variety. There can be no protection for varieties whose production requires the repeated use of a protected variety.

"Every protected cultivation may be used freely in improvement programs, both public and private. The option for a UPOV type variety protection system to allow for protection of the genetic 'pull', with the free use of such cultivations by the improver, for crossbreeding, will permit the constant progress of the improvement programs, both private and public. The system will be able to act as a stimulus for the private sector to invest in improvement of autogamous species."

Pinheiro Machado claimed that countries lacking the technology to identify the genetic codes for manipulating organisms will always be users of the mechanism, that is, the famous "black box," which the patent law attempts to protect. Furthermore, "This is a dispute between a world that has much to patent and a world that has virtually nothing. So, it is a very inequitable battle. On the other hand, Brazil now possesses the greatest genetic type wealth in the world, both in the animal and plant areas. We have an incomparable legacy that could be patented by foreigners because when they patent a certain genetic sequence, it can no longer be used."

Nelson Brasil, responding to a question regarding the pressure imposed on Brazil to adopt the patent law by Ambassador Carla Hills and the U.S. vice president, Dan Quayle, argues: "After the Paris Convention, the United States really began recognizing patents, adopting a totally open patent system.

"However, in the United States the 'super 301' is used for whatever it wishes. It is the Trade Act, the most comprehensive law of that country governing foreign commerce. Article 310 of the Foreign Trade Law states the following, precisely: 'When the domestic industry producing efficiently feels threatened, a temporary quota or discriminatory quota for each country and each situation may be administratively established for it in a matter of days, without any need for a judiciary decision.'

"Hence, by a mere administrative decision, through the 'super 301,' non-tariff or tariff barriers are created, contrary to the scope and intention of the GATT. Therefore, they don't need patents alone to protect themselves. They also have the 'super 301,' the Trade Act."

Senator Mario Covas sees no objective reason in the recognition of patents that could bring any additional development to the sectors involved (6-8-91).

Tania Munhoz expresses the position of Secretary Jose Lutzemberger, opposing the adoption and recognition of patents.

3.7.3 - Agroindustry

According to Ney Bittencourt Araujo (6-8-91), "The agroindustry complex in Brazil currently accounts for 40 percent of the GDP, 48 percent of the value of exports, and 68 percent of the spending of Brazilian families. It has become the only fundamentally strong sector, in which it has the capacity for a competitive advantage, even competing with countries that subsidize their agriculture heavily, as in the case of chicken and paper. It is one of the most closed economies in the world, even more than China's. We export only nine percent of the GDP, and import only six percent."

According to Minister Antonio Cabrera (6-8-91), the importance of agroindustry in a society becoming rapidly urbanized is vital, because there are increasingly fewer producers in the rural areas and more consumers in the urban areas.

Minister Antonio Cabrera claims that there is an obvious need to increase the value added of primary products based on agroindustrialization, not only because of the cost of transporting primary products, but also considering the need to make agriculture practicable in distant regions. He cites the example of hog production in Central Brazil. "Every time the grain is transported 'in natura,' we spend 38 percent of the total value of the grain, which will be consumed during the hauling; whereas, if we transport meat, only 3.22 percent of the total value of the meat would be consumed during transport in the same region."

The minister noted that, in the case of soybeans, considering the value added, "If, in the Central Brazil region, the producer, instead of selling a 60 kg bag of raw soybeans, sold that product converted into oil or flour, the price increase in terms of value would be about 102 percent."

He went on to say that, "In the case of corn, a bag of which turns out to be 70 percent meal and 28 percent flour,

undergoing an entire series of agroindustrial improvements, we would have a value added of 461 percent." However, he stressed: "We'll have a strong agroindustry only if we have plenty of raw material at an affordable price. In that respect Brazil loses much to the more developed economies. The cost of raw material in those countries is far lower than ours, because of the very high subsidies. The Americans and Europeans are equipped not only to take international markets from Brazil, but also to sell their products in this country. Today, we don't have a competition between Brazilian agriculture and European or American agriculture, but rather a real competition between the respective treasuries."

The tax policy has been another obstacle to access to the markets. According to Minister Antonio Cabrera, agriculture in Brazil is one of the most heavily taxed in the entire world. He cites the example of apples in Argentina: the average tax paid on apples is about 16 percent. Nearly 40 percent of the average billing is paid on that same product in Brazil. Agricultural input in Brazil has an average price 30 percent higher than in the countries comprising Mercosul [Common Market of the South]. Whereas, in Great Britain, market basket products are not taxable, in Brazil taxes of 23 to 30 percent are paid on them (6-8-91).

The sugar and alcohol agroindustry sector is a noteworthy example of technological progress and rapid response to market stimuli, when there is a clear and objective well-defined policy. Since the establishment of Proalcool [Alcohol Production Program] in 1975, the sector now has a nationalization index of 100 percent, with pioneer technologies. It also exports technology per se, and complete equipment and units through the "turn-key" system.

According to Jaime Penna Shutz (2-9-91), the sector's technological progress between 1975 and 1990 was as follows:

1) The grinding capacity of plants and distilleries rose from 5,000 tons of cane per day to 10,000 tons per day;

2) The fermenting time in the vats declined from 24 hours to 6 hours;

3) The alcohol content of the wine in distillation rose from 7.5 to 10.5 degrees GL;

4) With the use of shredders (national technology), the percentage of open cells rose from 85 to 95 percent. The yield from cane sugar extraction increased from 93 to 96 percent; the fermentation yield rose from 80 to 91 percent; and the distillation yield, from 98 to 99 percent;

5) Steam consumption in distillation declined from 3.4 kg of steam per liter of hydrous alcohol to only 1.9 kg;

6) The output of the boilers (national technology) rose from 66 to 87 percent;

7) The thermal efficiency of the turbines increased from 50 to 85 percent;

8) The poor wine from lees, previously rejected as highly pollutant, no longer pollutes, but is being used totally to produce methane gas and fertilizer as well.

Consequently, the alcohol production per ton of cane increased from 66 to 86 liters, and the investments for installing a unit for 150,000 liters, "turn-key," dropped from $16 million to $12 million.

Despite the progress achieved, the sector is currently in a state of crisis, confronting great uncertainty. The installed capacity on the national level is approximately 15 billion liters of alcohol per year. The current production is 12 billion liters, while the demand stands at over 13 billion liters. Now, however, there is space for increased production.

Moreover, it has been determined that the total cane cutting area in Brazil has been 4.2 million hectares since 1985. Cane production is 220 million tons per harvest. With this cane, 10.6 billion liters of hydrous alcohol and 1.3 billion liters of anhydrous alcohol could be produced.

Sugar production is 7.3 million tons, having stood at 8.1 million tons in 1986-87. The reason for the decline in production is a shortage of sugar cane.

Shutz claims that, at present, conflicting forces are affecting the sugar-alcohol sector, and that clearcut policies need to be defined, with a national guideline for the continuity of alcohol as an energy source. He also stresses that, in Sao Paulo State during 1968, 60 percent of the ground cane came from small-scale suppliers; in 1989, that figure dropped to 35 percent; and in 1991, the estimate was that it would be 30 percent. This represents a socially and economically undesirable concentration of income in the sector.

3.7.4 - Causes and dimensions of the technological lag in agroindustry

"Current investment in agricultural-livestock research is at one of its lowest levels in recent years. There is a process of deterioration in the entire structure of agricultural research in the country." (Murilo X. Flores, 6-8-91)

"The purchase of black boxes doesn't solve the problems, but rather heightens the dependence on foreign countries. Without precluding the indispensable cooperation with all scientific sectors in the world, Brazil urgently needs to develop its own science and technology. For this purpose, the first step is the allocation of funds capable of making it practicable (...), with the indispensable checking of results and efficiency." (L.C. Pinheiro Machado, 6-8-91)

"Recently, FOLHA DE SAO PAULO reported that only 13 percent of post-graduate candidates complete their theses. The fundamental reason is that the vast majority of people, the professionals taking the master's course, are not doing so because they have an urge, a tendency, or a vocation. They do so because they have no job market; they do so to substitute for the job market in an absolutely false post-graduate process. We must begin with proper instruction in literacy, making a primary correction and a secondary correction, and eliminating short courses. The post-graduate course is a short course at the university; in

other words, the university does not offer adequate training or a proper grading system. Later, it has to compensate through a post-graduate process that is very expensive. I also agree that the time spent in Brazil on a post-graduate process makes no sense." (L.C. Pinheiro Machado, 6-8-91)

"Respect for science and technology begins with respect for researchers and scientists. Hence, it is intolerable for the Brazilian public university, responsible for over 95 percent of the university scientific research in Brazil, to be on strike 62 days, without the government realizing the tragic situation that the majority of professors are experiencing. The average salary of a public university instructor today is about 25 percent of that earned in December 1987. In the Animal Husbandry Department of the Federal University of Santa Catarina, the annual expense budget is under $100,000. Yet that department produces the professionals who contribute over 70 percent of the state's agricultural GDP, represented by hogs, poultry, and bovines." (L.C. Pinheiro Machado, 6-8-91)

"Over 80 percent of the research projects in Brazil originate in the researcher's head, and this is a waste. The lack of priorities to benefit and stimulate certain sectors of scientific activity has been a cause of squandering the meager financial resources." (L.C. Pinheiro Machado, 6-8-91)

"Brazil's major flaw in the university system is the dissociation, the separation between university research and the nation's reality. It is impossible to discern whether the university or industry is to blame. Perhaps both are to blame, or even a third party that has failed to act as a catalyst, bringing them into suitable proximity." (Nelson Brasil, 6-8-91)

"I doubt that a business owner would go to the BNDES [National Bank for Economic and Social Development] or the Finep [Funding Authority for Studies and Projects] to obtain funds. They don't want to hear about on-going research. They only want to hear about projects that are all ready for transfer." (Maurilio A. Moreira, 2-9-91)

"(...) The technologies of the developed countries with temperate climates are not suited to our country (...). It's impossible for us to treat an animal raised in an environment with six months of snow and one raised in a tropical region in the same way." (L.C. Pinheiro Machado)

"We can't transfer products developed in temperate climates to our country, and this requires Brazilian research; all research must be carried out here, for tropical conditions." (Ney Bittencourt Araujo)

"The multinational companies (fine chemistry and biotechnology) that have only a branch of their structures, an off-shoot, located in the country, are, with the opening for international competition, calmly shutting down their productive activities here in the country, and starting to import the product. The economic activity of those firms remains sound. I would say even more sound, because the product manufactured in the country is put on a price schedule by the CIP [Interministerial Price Council]; while the imported product is sold and marketed freely. So, the price treatment on the internal market penalizes the national company tremendously, causing, producing, and leading to the development of the multinational company, without hurting or burdening it." (Nelson Brasil, 6-8-91)

"So, from the standpoint of quality and technological information, we are state of the art; now, everything will go well. Unfortunately not. The basic problem is called price. We have a product, insulin, and our sales price for it is half the international market price." (...) "Conclusion: my strongest competitor, bringing the product from Denmark, has a price that is double mine on the Brazilian market." (Guilherme Emerich, 6-8-91)

"Brazil has an extraordinary competive capacity in certain agroindustrial sectors, for example, meat, oil seeds, etc.; but we are limited by protectionist policies and market restrictions in the first world, which would necessarily be a means of swindling, in view of our openness. We can't allow ourselves to be forced to accept (...) a situation in which we have to be open to areas in which we aren't competitive, and accept a protectionism in those in which we are competitive." (Ney Bittencourt Araujo, 6-8-91)

"Brazil was a penicillin producer, and was self-sufficient for many years, even exporting. Now we are importing. This is retrogression in the name of a liberalism and an openness, that I would say has been created somewhat hastily." (...) "Of the seven plants located in Brazil that were manufacturing antibiotics, six have closed their doors. There is only one, Cibran, which is a national enterprise in Rio, manufacturing antibiotics." (Nelson Brasil, 6-8-91)

"To promote market openness during a period of economic recession is suicide." (Nelson Brasil, 6-8-91)

"Despite the fact that it maintains a position as a major market for Brazilian products, the United States has not ceased to adopt a long list of non-tariff barriers, which may be divided into two parts: There are explicit measures, such as the imposition of import quotas, and subjective measures, such as customs procedures and health or safety regulations." (GAZETA MERCANTIL, 3-8-91, according to Nelson Brasil, 6-8-91)

"The researcher will only engage in applied research, and will only develop technology, insofar as he stands to profit." (Guilherme Emerich, 6-8-91)

"Technological property is one thing, and ownership of nature is something totally different...nature can't be appropriated." (Tania Munhoz, 6-8-91)

"Eligible for privileges are all products of primary technology that have undergone a verifiable, stable, genetic alteration." (Guilherme Emerich, 6-8-91)

"I'm not disturbed by the recognition (of the patent) for processes. The major problem is the patenting of the product; it's the patenting. In the case of biotechnology, it's not the process of modifying the microorganism; the problem is the registration of the patent for the modified live being. This is totally contrary to the interests of an

emerging country like Brazil, with great potential for development in that field of tropical sciences." (Nelson Brasil)

"On the European Common Market, a cow receives as a subsidy the equivalent of $2,400 per year, per capita. This means that a European cow has a per capita income exceeding the income of the majority of the world's population. The status of subsidies in today's world is approximately $240 billion for agriculture, which totally castrates our capacity to integrate our economy." (Ney B. Araujo, 6-8-91) Eighty percent of the subsidies on the European Common Market is concentrated in the hands of 20 percent of the farm owners.

"(...) When missions arrive from the IMF or the World Bank, the first condition is: there can be no subsidy for Brazilian agriculture. However, North American agriculture is very heavily subsidized, with $130 billion every year. This was stated by the U.S. National Academy of Sciences, in a report that I have with me." (L.C. Pinheiro Machado, 6-8-91)

"Brazil has lost much to the more developed economies in agroindustrial competitive power, because those countries subsidize raw material drastically. In the European Economic Community, we shall find that the European farmer has a certain production, and that 40 percent of what he receives is an explicit subsidy, money provided on a non-reimbursable basis: milk, 73 percent; wheat, 49 percent; sugar, 41 percent.

"The same situation occurs in the United States: sugar, 60 percent; milk, 58 percent; and wheat, 63 percent. We are importing wheat from the United States, and an average of 63 percent of its price on the internal market consists of an explicit subsidy. This means that they are in a position to have a far more advanced, far more developed agroindustry than ours." (Minister Antonio Cabrera, 2-9-91)

"The Brazilian tax policy is completely unfair, because the taxes are indirect and, in fact, the farmer is forced to give the government one bag of corn out of every five, as a tax. Obviously, with that extremely high tax, there is an incentive for unlawful concealment. And we now expect only 50 percent of the cattle and 50 percent of the hogs to be slaughtered under government inspection, because the other 50 percent are in the underground economy, in the unlawful concealed economy. This is a dreadful obstacle to competitiveness that will have to be watched." (Ney Bittencourt Araujo, 6-8-91)

"I would also like to stress, in terms of taxation, that Brazilian agriculture (including agroindustry, the leading edge product, the already manufactured product) is one of the most heavily taxed agricultures in the entire world.

"This is one of the obstacles to the generation of new technologies and the modernization of our equipment. Why? Because, you see, if the more developed countries, the first world nations, which are the richest, with a far better nutritional index than ours, don't tax their basic market basket, why do we, who have greater nutritional problems and a lower per capita income, levy taxes?

"Let's take the example of Great Britain: that country doesn't tax its basic market basket a cent, or a pound. No tax is paid on any product in the British citizen's basic market basket, including clothing. In Brazil, it's completely different. On the average, every time the housewife goes to a supermarket, she has from 23 to 30 percent taxes in that shopping cart." (Minister Antonio Cabrera, 2-9-91)

"I have always claimed: high interest today means an empty plate tomorrow. The farmer won't plant with high interest." (Minister Antonio Cabrera, 2-9-91)

"I would like to say, on the topic of chicken, which caused the Senator such concern and shock, that Brazil exports 350,000 tons of chicken, all with foreign grandparents. There is 100 percent technological dependence in that area, but I feel very much at ease, because, as president of Embrapa, I had occasion to initiate a process of independence which, of course, is being pursued. We have all the conditions for it, if there is an allocation of human and material resources within a relatively short time. And, in this case, imports of genetic material cost $7 million. But that's not all. The fact is that, to support that genetic material in an inadequate breeding system, we must import $120 million worth of additives.

"Well, we import genetic material in that area not only from the United States, but from Canada, the Netherlands, Israel, and France as well. Why is the nation losing, where and why, in the patenting? In what respect is it losing? It is in the opportunity to use its own material. That is the worst damage of all. Why? Because that material can't be used. Once it's patented, it may only be used through pirating. And it would really be strange for us Brazilians to be using materials given to us by nature in a pirating manner. It's intolerable. I consider it ethically intolerable." (L.C. Pinheiro Machado, 6-8-91)

"In poor regions, like the Northeast, technological innovation has a market restriction, as in the case of Bahia's manioc producers. Embrapa is developing technology for manioc. When farmers adopt modern techniques, there is a rise in the physical productivity of manioc. In a restricted market, the increase in physical supply results in a reduction in the product's price. At a lower price, the innovative technology doesn't pay for the product; therefore, it reverts to traditional technology. Hence, to incorporate new levels of technology, it is essential that small producers be organized and trained to work with the agroindustrial sector, so that they may add value to their agricultural product." (Murilo Xavier Flores, 6-8-91)

3.7.5. Proposal for making the sector viable

Adoption of the law on seed and protection of UPOV type varieties, as suggested by Murilo Xavier Flores.

Integration of private enterprise with the university and research centers, through sectorial groups, based on well-defined objectives (Ney Bittencourt de Araujo, 6-8-91).

Training of technology managers, making it possible to integrate research, in an interdepartmental and multidisciplinary fashion, with the business and university integration (Ney Bittencourt de Araujo, 6-8-91).

Incentive for joint ventures with international partners, as a means of achieving national expertise and transfer of technology (Ney Bittencourt de Araujo, 6-8-91).

Research in agriculture should be considered a harmonious, complex whole; it should not be divided, fragmented, or compartmentalized. This is because, to be technically and economically efficient, it must be treated as such both socially and culturally, at the same time. This means that multi- and inter-disciplinary activity is a prerequisite for the development of research that will create and generate the solutions required by the national agriculture (L.C. Pinheiro Machado, 6-8-91).

Undertaking a systematic review, based on the understanding that nature is a world of relations, and that any unilateral action can bring disastrous effects (observe monoculture as an example). Even more painful and not clearly understood is the planning of any action in the areas of education, research, extension, and production. Obviously, to achieve that understanding and convert it into action, there must, in fact be deepseated, urgent changes, beginning with education, where the brains that will direct the process are groomed (L.C. Pinheiro Machado, 6-8-91).

Minimize the genetic dependence on foreign countries, through a better understanding of the Brazilian plant and animal genetic assets, as well as a guarantee for their preservation, development, and appreciation, rejecting the adoption or recognition of patents (L.C. Pinheiro Machado, 6-8-91).

Integrate into the Brazilian agricultural model a group of principles, resources, and objectives that will, in time, lead to the attainment of a sustainable agriculture, in the broadest sense of the term. In other words, there would be environmental protection, a high biological product quality, positive economic yields, use of techniques affordable to and assimilated by producers, and administrative viability that is intensely balanced with a real concern for social improvement. In other words, it is critical that a model be established endowed with human and technological resources capable of making it viable in our country. However, it will succeed only if it is scientifically based. This entails the need for permanent scientific research, both in the basic area, which is a priority, and in technology, which must respond to the immediate and future production requirements (L.C. Pinheiro Machado, 6-8-91).

Establish the Council for Advanced Studies and Technological Evaluation, stipulated in the Chamber of Deputies' Statutes, which will have to be a major forum for debating technological options for the country, and advising congress members on their legislative action, thus allowing for a permanent evaluation of scientific and technological activities. It should offer subsidies capable of contributing to development and of assessing the efficiency of the allocation of funds. It could also suggest new priorities or corrections directed toward the scientific and technical policy (L.C. Pinheiro Machado, 6-8-91).

Provide the national biotechnology sector with 60,000 scientists and technicians, eliminating the present personnel shortage, with 4,000 now existing. That may perhaps be one of the most serious obstacles to scientific and technical development in the biotechnological sector (Guilherme Emrich, 6-8-91).

A five-year delay in the adoption of patents for any chemical products, without retroactive recognition of international patents or previous applications already published.

A guarantee for Brazilian industry, without any time limit, of freedom to continue producing and marketing products, or using processes already being used on the national market as of the date of promulgation of the law (Guilherme Emrich, 6-8-91).

Establishment of an energy policy that will clearly define the position of alcohol among the national energy sources (Jaime Penna Shutz, 2-9-91).

Increased production of sugar cane, in view of the current demand for hydrous alcohol and for sugar, and the opportunity being missed for exporting. The strangulation point lies in cane farming, the total production of which has remained stagnant during the past five years, rather than in technology or industrial activity (Jaime Penna Shutz, 2-8-91).

3.8 Educational policies, scientific education, and training of human resources for science and technology

Education as a basis for cultural and material fulfillment of a nation is an age-old truth repeated to the point of exhaustion. Lynaldo Cavalcanti de Albuquerque

Educational policy and its coordination with the policy on science and technology, and the coordination of both, in turn, with various sectorial policies, was never a real commitment in a public policy strategy of the Brazilian government. Octavio Elisio

3.8.1 - The educational situation in the country

3.8.1.1 - Educational policy and S&T

The charge made in the Commission by the Secretary of Science and Technology of Minas Gerais and ex-Federal Deputy, Octavio Elisio, author of the Bill on Guidelines and Bases for National Education, cites the lack of coordination between educational policy and scientific and technical policy, and between both and industrial or agricultural policy, or any other type of sectorial policy. The change sought by the Collor government in terms of industrial and foreign trade policy is also inconsistent with an educational policy committed to the country's modernization.

With regard to secondary education, Octavio Elisio made the following statement:

"Secondary education has always been marginalized in Brazilian educational policy, and this is quite serious, since secondary education does not merely have the fundamental role of training, to supplement the student's knowledge, so as to guarantee his access to higher education. It is also an area whose mission of completing

professional training has always been a requirement in Brazil's social reality." (Octavio Elisio, 3-9-91)

Octavio Elisio's position on the Normal [Teacher Training] School is clear and objective: "The 1971 educational reform discarded one of the most important professional schools that the country had, namely, the Normal School, and was unquestionably responsible for the major loss of quality in the country's primary education." (Octavio Elisio, 3-9-91)

The policy on professional education was considered important for ensuring the technological modernization of Brazilian industry. Research conducted by Luciano Coutinho for the Sao Paulo Secretariat of Science and Technology "demonstrated quite clearly a time lag in Brazilian industry, including that of Sao Paulo, with respect to science and technology, and made it clear that the fundamental lag in that process is an educational issue." (Octavio Elisio, 3-9-91)

According to Marcos Arruda, quoted by Octavio Elisio, a policy in favor of competitiveness should consider education among its major priorities. He claims that the development model adopted by Brazil, which valued cheap labor as a principal factor giving our industry comparative advantages, led education into the neglect to which it has been relegated, because the productive sector did not demand trained human resources (Octavio Elisio, 3-9-91).

He also notes the practice of citing examples of other countries' economic success without showing the entire picture, in which education holds a leading position. He claims: "Generally speaking, we have a habit of citing the economic accomplishments of other countries, describing only one side of the picture. However, if we assess the modernization of those countries, we shall find that education plays a preeminent role." (Marcos Arruda, apud Octavio Elisio, 3-9-91). This view was shared, with different comments, by Lynaldo Cavalcanti, when he asserted: "The existence of an integrated, quality educational system, serving the population universe, is a requirement doubly necessary for the country's scientific and technical expertise" (Lynaldo Cavalcanti, "The Scientific and Technical Lag," p. 7, a work written by him, and submitted by the author to the Commission on 23-9-91).

Marcos Arruda gives a reminder that, until the swearing in of the present education minister, the Collor government offered only two major goals: "one, the literacy that has not materialized effectively in any objective action to date, and the other, a policy to construct monumental educational establishments throughout the country."

At the meeting on 17-6-91, Mario Bernardini declared that, during the 1960's and 1970's, the country neglected investment in education and the training of skilled labor to operate the instruments vital to the modern industrial pattern, essentially linked to electronic data processing systems on which the entire production process depends today. The countries that made rapid technological and economic progress, such as Japan, Italy, South Korea, and Taiwan, pursued the opposite path from ours: they invested heavily in education.

The present Federal Government, sworn in on 15 March 1990, has not yet sent its "national educational plan" to the National Congress. As Article 214 of the Federal Constitution states, it is to be established as a law and will have a multiannual duration, "aimed at coordinating and developing education on its various levels. It is intended to integrate the public authorities' action leading to:

I) eradication of illiteracy;
II) universal school attendance;
III) an improvement in the quality of education;
IV) job training;
V) the country's humanistic, scientific, and technical advancement." Hence, there is no constitutionally established educational policy that has been debated publicly and approved by the National Congress.

According to Jose Miranda Dias, who gave his deposition at the meeting on 17-9-91, the new Informatics Law, although intended to stimulate production in the country, shows three errors: 1) it does not contain means capable of promoting technological expertise; 2) it transferred to the Informatics Policy Administration (Conin [National Council for Informatics and Automation] and the STC) rules which, if specified in the law, would be stabilized; and 3) it did not establish guidelines or incentives for promoting exports. Thus, production in the country could still be saved, but technological expertise appears to be jeopardized over the short and medium term. Moreover, unless economic stability is fostered, there will be no new investments in the sector.

Paulo Feldman, in his deposition of 24-6-91, made the following statement, corroborating that of Jose M. Dias, quoted previously: "The failure to train and qualify adequate skilled human resources was one of the main shortcomings of the National Informatics Policy." The conclusion inferred from those assertions is that, at least in the leading edge sector of informatics, the Federal Government's policy is not conducive to technological expertise. As the business owner Abraham Kazinski notes: "It does no good for the government to talk about industrial competitiveness without considering an industrial policy that will prioritize investments in science and technology. A few major companies, notably exporters, are filling in the state's gaps, investing in the development of their own technology and in the educational and technical training of their operational personnel. Untrained employees are incapable of handling modern machinery and coping with advanced technologies. It's impossible to discuss statistical control of a process with an operator who lacks knowledge of mathematics, statistics, and technical design, for example" (Abraham Kazinsky, 2-9-91).

Cofap, Kazinsky's company, employing 18,000 persons directly, was suffering from a lack of culture among its employees, and attempted to compensate for it with an offer of schooling and makeup courses. However, the makeup courses operated poorly, showing a dropout rate of between 80 and 85 percent after four years. To train the employees to understand the statistical control of a process, the makeup course curriculum was enhanced with instruction in design (Abraham Kazinsky, 2-9-91).

Since the makeup course could not solve the problem, Cofap created a first level school in Maua, where 70 percent of the company's employees reside. The funds assigned to the school represent only 25 percent of the education-wage earned in the company. A study was made, and it was found that, if Cofap had the authority to apply the entire education-wage earned in the company, it could offer free schooling to 40 percent of the population of school age in the municipality of Maua. If Cofap alone assumed responsibility for 40 percent, other Maua business firms could come up with the necessary 60 percent. As a result, the municipality would not have to spend anything on school maintenance, and could pay the teachers salaries equal to those of the Cofap school, hence, the highest in Sao Paulo (Abraham Kazinsky, 2-9-91).

3.8.1.2 - The status of the educational system

The data presented by Lynaldo Cavalcanti attest to what he termed the "deterioration of the educational system," and, in his own words, are "alarming, and depict the collapse of the educational system. The worst part is that, since the 1980's, the deterioration of education on all levels and in all branches has become more severe."

The profile drawn by Lynaldo Cavalcani shows education in Brazil with a school dropout rate of 80 percent between the first and eighth grades on the first level. Out of every 1,000 students enrolled in the first level's first grade, 232 reach the second, 145 reach the fourth, only 86 attain the fifth grade, 63 go as far as the third grade of the second level, 48 enter higher education, and only eight students complete this level of schooling.

The situation described by Lynaldo Cavalcani also depicts Brazil as a country with very low rates of academic achievement, with a rise in the number of illiterates, nearly 26 percent of children of school age out of school, and spending of over 30 percent of the funds that are allocated on first level pupils' food (reflecting the dreadful living conditions of the Brazilian population). These facts "show the under-education of our people, indicate the increase in social inequalities, and expose the exhaustion of the educational policy models in effect" (Lynaldo Cavalcanti, "The Scientific and Technical Lag," p. 6).

Nearly all the deponents, with greater or lesser emphasis, referred to educational problems as Brazil's basic problems, the solution to which is necessary for our scientific and technical progress.

Luciano Coutinho, of Unicamp, the first deponent of this Investigative Commission, cited "Brazil's educational tragedy," marked by a drastic narrowing of the educational profile (also attested by the IBGE data submitted by Lynaldo Calvacanti), and by a "quantitative expansion to the detriment of the qualitative aspect."

The deponents, representing countless segments of productive sectors and institutions training human resources and producing research, as well as representatives of the federal and state public authorities, put Brazil's educational problems in context on all levels. They also noted the damage stemming from its poor quality to the economy and to the Brazilian society as a whole. Should the depositions not suffice, the entire country was updated with the countless reports carried by the press, chiefly the print press, which have been and are constantly explaining to the Brazilian population the flaws in Brazil's education, particularly on the fundamental and intermediate level.

Octavio Elisio analyzed the main aspects of the public education problems on the basic (fundamental and intermediate level) in the following terms:

"Basic education in the country is virtually the responsibility of states and municipalities. Generally speaking, the states and municipalities have not yet committed to education the 25 percent (of the funds) that the Constitution requires. In general, a large portion of those funds has been channeled to pay personnel, with teachers usually earning extremely precarious salaries. In nearly all states (in mine, Minas Gerais, it was no different), the present government virtually began with the first and second level teachers on strike, demanding salary hikes. This typifies basic public education in the country today: the very poor salary and, primarily, the lack of an instructional proposal committed to compulsory fundamental schooling for eight years, in keeping with the real situation of the student attending." (Octavio Elisio, 3-9-91)

3.8.1.2.1 - Instability of scientific education

In his analysis of scientific education, Lynaldo Cavalcanti declared that,

In Brazil, "there prevails a culture that dissociates thinking from doing. Instruction on all levels is verbalizing and generic, giving priority to illustration, to the detriment of experimentation, and to rationalization, to the detriment of empirical learning. The concern with basic education is confined to the issue of literacy which, in itself alone, would be insufficient and ineffective. The teaching of the sciences and mathematics is deficient on the first and second levels, dissociated from the reality ordinarily experienced by the students, and lacking any connection with everyday events. These distortions are perpetuated in higher education by the imbalance between academic instruction and professional training.

"To a large extent, this shortcoming also reflects a distortion in teacher training, which puts the scientifically elaborated, didactic-pedagogical content on a secondary level" (Lynaldo Cavalcanti, op. cit, p. 7).

3.8.1.2.2 - Gap in intermediate personnel

There is a serious lack of intermediate personnel between basic education and higher-level training. As Lynaldo Cavalcanti remarks:

"This problem represents one of the most serious constraints on our educational system, which is incapable of resolving the dissociation between education and work. Second level education has remained in a secondary position, excluded from the educational policies. A considerable segment, represented by the system of federal technical schools and federal centers for technological education, has shown a vegetative growth inadequate to

meet the country's requirements. The expansion programs in technological education have been held captive by the snares of electoral and demagogic interests" (Lynaldo Cavalcanti, op. cit., p. 9).

The shortage of intermediate personnel to meet the nation's technological demands is very severe. In 1988, the number of students enrolled in technical courses (including those of the Senai) was 106,424; while those enrolled in advanced engineering courses totaled 187,499: in other words, nearly two (1.76) engineering students for each student/technician. In the developed countries, the situation is the reverse: there are four or five technicians for each engineer. "As serious as this distortion is the quality of the engineer trained in our institutions" (Lynaldo Cavalcanti, op., cit. p. 9).

Senai's technical director, Lauro Pio de Miranda, in his deposition to the Investigative Commission, reported that the institution offers 65 technical courses: 18 regular and 47 special. All the courses are single-purpose, and are intended to serve the industrial sector. According to the deponent, "Senai's major concern, which we should perceive today, is that 90 percent of the firms are small and medium-sized. Senai's main action at present is aimed at providing for those companies" (Lauro Pio de Miranda, 3-9-91).

"Senai trains nearly 1.2 million young people annually, including apprentices, skilled workers, and second level technicians" (Pio de Miranda, 3-9-91). The institution has been pressured to embark on training technologists, but has doubts about the acceptance of that professional's image on the job market" (Pio de Miranda, 3-9-91).

As for the instruction offered by Senai, Mario Bernardini, vice president of Abimaq, gave the following testimony at the meeting on 17-6-91:

"Senai should be completely revised. Although it was supposed to be basically a private enterprise, it ended up becoming a public organ, now having a structure, a superstructure, clout, etc. It furnishes inadequate labor to the company, which has to redirect it and retrain it, but not in the areas of expertise that the company needs. In other words, I need systems analysts, and CNC machine programmers or operators, and the Senai in my region offers me courses for mechanical adjusters and electricians. By law, I'm obliged to maintain a certain number of apprentices in Senai which, when they are trained, will simply not be of any use to me. I have to retrain them. It's a double expenditure, and an absolute distortion that needs to be reconsidered. This pertains to labor."

The training of technologists (higher level technicians taught in courses of brief duration), after having been encouraged during the 1970's, started to decline in the 1980's for lack of policies, incentives, and a decision of the Federal Government. That type of training is already established in various developed countries (Lynaldo Cavalcanti, op. cit., p. 9).

Although it is not fostering the training of technologists, the Capes/MEC, based on the growing relationship between scientific and technical development, is promoting a national system of short courses. They are aimed at entrepreneurs and the productive sector in general, with the universities' cooperation, because the improvement courses allow for more suitable training in a shorter period, and constant refresher classes for personnel in the technological and business areas (Eunice Durhan, 23-9-91).

3.8.1.2.3 - The crisis in the university system

The crisis in the universities was clearly depicted by Lynaldo Cavalcanti, who commented:

"No one is unaware of the deepseated crisis in Brazil's higher educational system, with the lack of material and human resources only one of its more preponderant aspects. Countless other factors inside and outside the university institution certainly contribute to the distortion of the university system. The state of poverty, the failure of casuistical and palliative solutions, and the lack of clearcut policies representing the social segments involved have led the public university system into a deflation of its aspirations for scientific and technical mastery and to an abdication of its competence. The defense of university autonomy was an historic battle, seeking to protect the universities from external politico-administrative interference. Their victory was achieved as an attribute explicitly recorded in the Constitutional Charter. Nevertheless, the situations that we are witnessing at present are those of disrespect for this prerogative. The universities are finding themselves threatened and increasingly subjected to external impositions and decisions emanating from other government agencies and authorities" (Lynaldo Cavalcanti, op. cit., p. 11).

Professor Lynaldo Cavalcanti's charges could be added to those of Octavio Elisio, when he discussed the issue of the attack being made against the Brazilian public university. He claims:

"If there is any place where public education could be guaranteed as competent, it is on the third level. Unfortunately, that university, like public education in general, is being subjected to an intensive campaign of discreditation and downgrading. That Brazilian public education is currently responsible for a major effort to train human resources for research in the country" (Octavio Elisio, 3-9-91).

Enio Candotti, president of the Brazilian Association for the Advancement of Science - SBPC, in commenting on the funds invested in research, stated that, during the 1980's, those invested in research by the FNDCT, CNPq, and state agencies for promoting research, stood between $200 and $250 million per year. Those amounts remained constant during the decade, even with the proliferation of the number of researchers, influencing the quality of their work. In his view, the educational problem could be solved in five or ten years, but not with the annihilation of the universities, which lack an educational plan or prospects because of the Congress' constant postponement of the LDB examination (Enio Candotti, 11-6-91).

According to Candotti, the only program saved during the last decade was that for training human resources, thanks

to a series of measures adopted, mainly in 1986-87, making significant progress possible in the study grants program. However, Candotti comments: " Now, whereas on the one hand we see the success of this program, we also perceive that it has aggravated the problem internally, because we don't know how to employ or use the researchers trained in the country or abroad" (Enio Candotti, 11-6-91).

Continuing his deposition, Candotti voices great concern in the following remarks:

"What worries us most at present (and I think that it requires exposure in this Chamber) is that we are destroying our seeds, we are destroying the little that we managed to construct, or to preserve, throughout those 10 years of disaster for our economy" (Enio Candotti, 11-6-91).

Professor Enio Candotti's statements concerning the funds for research are echoed in those of the then secretary of science and technology of the Presidency of the Republic, Professor Jose Goldemberg. In discussing financial resources, he claims that the Capes and CNPq support 5,000 grant-holders abroad, at an annual cost of $150 million, and that, each year, 150 grant-holders return to the country. "Since the total volume of funds has been kept approximately constant for a decade, and the number of scientists in Brazil is increasing, there is greater competition for the funds" (Jose Goldemberg, 15-8-91).

The funds for paying the post-graduate course expenses have been reduced by inflation and by the contingency system created by the government. Since study grants are equivalent to personnel expenses, the cuts affect the disbursement funds. According to Eunice Durhan, then director of Capes and secretary of higher education in the MEC, there is a need for a clear connection between the disbursement funds and those for grants, so that we will not have programs with qualified instructors and excellent students prevented from conducting research because of lack of funds for minimal support (Eunice Durhan, 23-9-91).

According to Eunice Durhan, another problem is the early retirements. She claims that the country has spent too much time and money training doctorate holders, who retire immediately after their certification at age 45 to 48. At that age, the researcher is experienced for guiding work teams and training those who are to follow. At Sao Paulo University, for example, during the next two years there will be a major decline in production, and the retirees will start accounting for 40 percent of the instructors' payroll, making it impossible to pay the professors a decent salary. This is certainly a problem of concern to the Legislative Branch, for which legislative action is important (Eunice Durhan, 23-9-91).

According to Durhan, another problem is the inclusion of the universities in the Single Juridical System, which treats the university professor as a public servant. This allows for job stability before the professor proves his productivity. She claims that this early stability is a mistake, which can only be corrected by giving the universities a juridical status of their own, as is included in the Federal Government's proposal to amend the Constitution. This is essential for the development of the universities and the process of training human resources. With their own juridical status, the problem of contracting foreign instructors would be solved. This is essential because, when a good senior researcher is brought to Brazil, he trains a generation of researchers (Eunice Durhan, 23-9-91).

According to Eunice Durhan, the other major problems are: the long periods for conferring post-graduate degrees, particularly for the master's degree; and the great concentration of post-graduate courses and enrollments in the Southeast region, primarily in the doctoral courses.

The average time for completing the work for the master's degree has been 57 months, and for the doctorate, 68 months. Eunice Durhan remarks: "The master's level is a training area that is being deactivated in the vast majority of developed countries, in favor of a more rapid doctorate" (Eunice Durhan, 23-9-91).

The Capes is currently discussing with the universities "the absolute necessity for a resizing of the master's course in this country, in favor of a resizing of the doctoral course, as a priority area in the training of the scientist and researcher" (Eunice Durhan, 23-9-91).

The problem of the unequal distribution of post-graduate courses shows the following characteristics: 90 percent of the doctorate holders and a third of the master's holders are concentrated in the Southeast region.

The critical situation in which the universities find themselves also has endogenous determining factors that generate distortions in their organization and operation, as was admitted by Professor Lynaldo Cavalcanti. "For example, we underscore the corporative tendencies, whether in the organization of professions or through other types of corporativism, such as the institutional, departmental, or union. This phenomenon has helped to allow the interests of groups and segments to prevail over the institution's major commitments to the society and the nation. It has had harmful effects on university affirmation, not merely from the standpoint of quality and efficiency, but primarily from that of the social and democratic commitment expected of the university" (Lynaldo Cavalcanti, op. cit., p. 11).

In an address delivered at the meeting of 17-6-91, Senator Joao Calmon declared: "The claim that Brazil has already allocated sufficient, reasonable funds for education is, unfortunately, untrue." He also observed: "The status of education in Brazil is catastrophic. We have 20 million illiterates (this year's census cites 36 million); 87 percent of the children don't finish their first level schooling, and hence are considered functionally illiterate. The second level is undergoing an unprecedented crisis; the universities are debilitated. And, amid that entire Dantesque situation, during this fiscal year the Executive Branch sent a message to Congress making 95 percent of the budget funds earmarked for investment unavailable. It didn't even offer to make an exception for an area protected by a constitutional ruling: a minimum of 18 percent of the revenue, and 25 percent of the state and municipal taxes."

3.8.1.3 - Distortions in the scientific-technical base profile

There is a lack of critical mass in Brazil's post-graduate area (Luciano Coutinho). "The supply of researchers with doctorates active in the universities and in the overall work force in Brazil totals nearly 20,000. Of that number fewer than 5 percent are active in engineering fields on the post-graduate level, and presumably engaged in research" (Lynaldo Cavalcanti, op. cit., p. 11). "Considering that the production of technology depends (among other factors) on the degree of scientific maturity and the presence of a critical mass of technical competence in areas and fields of applied knowledge with a strategic purpose, the aspirations for technological development are threatened so long as distortions, imbalances, and low standards of general qualification persist" (Lynaldo Cavalcanti, op. cit., p. 12).

According to a document jointly prepared by the Brazilian Association of Engineering Education and the Federal Council on Engineering, Architecture, and Agronomy, in 1988 there were 4,300 advanced courses in the country. They had an enrollment of 1.5 million students, 66 percent of whom were enrolled in the fields of human and social sciences. Only 185 of the courses (4.3 percent) were in the engineering field, with 9.7 percent of the total student body (187,499 students).

"That student distribution probably reflects a serious disproportion from a quantitative standpoint, in comparison with our society's requirements. For example, this becomes evident if we consider the fact that only 2.77 percent of students are enrolled in agrarian sciences in a country in which the economy depends largely on agricultural-livestock production. The share of engineering sciences may also be considered extremely low, when compared with that in other countries, such as Japan, where it amounts to nearly 70 percent of the total" (apud Lynaldo Cavalcanti, op. cit., p. 12).

The seriousness of that distribution becomes evident in the ratio between the number of engineers and the number of persons comprising the economically active population. In Brazil, it is only 6:1,000, whereas in developed countries such as the U.S., Japan, Great Britain, and Germany, it is 25:1,000; hence, 4.2 times higher than in Brazil. In absolute figures, the engineer population was estimated at 400,000, and the active population at 60 million.

According to Nelson Brasil, president of the Brazilian Association of Fine Chemistry Industries - Abifina, there is a dysfunction in the sector due to the location of the researcher's training. At a meeting held on 6-8-91, the deponent remarked: "We can't think of scientific creativity solely as an end in itself. I respect the position of professors and universities when they defend freedom of creativity, but I warn that our resources are meager and, from the standpoint of academic training, especially on the post-graduate level, it is usually taken abroad. Hence, the normal tendency, at least in the chemical sector, is toward intellectual production aimed at solving first world problems. So, there is a very great need for us to make the university familiar with the Brazilian reality in the chemical area: I mean that the applications, the studies to be conducted, must be directed toward our country's reality."

3.8.2 - Suggestions from the deponents

1) We must have a diversified third level system with universities which, besides training human resources, have a commitment to scientific and technological research, essentially to scientific research and the production of information; and with schools on the higher level training human resources that have a commitment to competence. (Octavio Elisio)

2) The country's enormous network of research institutions, currently producing a great volume of research and researchers, needs to be appreciated as part of a scientific and technical policy strategy. (Octavio Elisio)

3) The technological centers could become an important interface for the university's rapprochement with the productive sector. (Octavio Elisio)

4) The National Congress is an important space for the debate on the country's scientific and technical policy. The establishment of the Adanced Studies Center in the Chamber of Deputies is an extremely significant means enabling the National Congress, with its authority, to play a fundamental role in that strategy for the country's scientific and technical policy. (Octavio Elisio and Lynaldo Cavalcanti)

5) Regardless of whether it is professionalizing or not, the second level school's curriculum content must be committed to scientific and technical training (polytechnical training) as depicted in the Bill on Guidelines and Bases of Education. (Octavio Elisio)

6) If the municipal funds for mandatory use in education were used essentially to pay salaries, and the Federal Government, instead of building large luxury premises for first level education, transferred the education-salary funds to the municipalities to create the entire infrastructural portion of the schools, the municipality would have budget funds for training teachers and improving education. (Octavio Elisio)

7) Allow business firms to apply funds collected for education-salary directly to the development and maintenance of education in the communities in which they are established. (Abraham Kazinsky)

8) It is essential for the National Congress to offer the nation, as a result of the work of this Commission, "a document consolidating the observations, analyses, and courses of action indicated for overcoming the technological lag, with the state playing a preeminent role in that process." (Lynaldo Cavalcanti)

9) Reestablishment of the National Scientific and Technical Development System. (Lynaldo Cavalcanti)

10) Salvaging of the research institutions, which "need to be interconnected with a national system to provide various types of services, such as offering specific courses of short duration..." (Lynaldo Cavalcanti)

11) Making the exercise of university autonomy effective, by "clarifying the relations between the university, government, and society." This requires "the elimination of ambiguity and of leftover measures creating obstacles to the full exercise of that autonomy." (Lynaldo Cavalcanti)

12) Creation of a juridical status of their own for public universities, as stated in the Federal Government's proposal for a constitutional amendment. (Eunice Durhan)

3.9 - National and regional policies

The depositions relating to government policies in the scientific and technical area appeared polarized. The majority of representatives from the productive sector, human resource training institutions, and research institutions accused the Federal Government of abandoning policies and action that had been successful, and for dismantling technological research and development in the country. On the other hand, representatives of the Executive Branch defended the goverment's policies and action, demanded of the private sector a greater share in financing the country's technological research and development, and denied the deliberate scrapping of the university and of industry in the country.

The specific depositions on national policies were given at the meeting on 15 August 1991, entitled "Scientific and Technical Dependence and National Policies." The regional policies were the topic of the meeting on 20 August 1991, entitled "Science and Technology and Regional Policies."

The specific meetings do not mean that the policies were not discussed by other deponents appearing at the CPMI on different dates. As may be noted in all the other parts of the Report, the Federal Government's policies for scientific and technical fields were discussed on all occasions.

3.9.1 - National policies

3.9.1.1 - Funds for science and technology

The leading government official called to make a deposition on policies in science and technology, the then Federal Government Secretary of Science and Technology, Jose Goldemberg, initially declared:

"...There has been no scrapping or dismantling of an activity important to the nation's development; that would look like a dismantling directed toward other interests, and not the national interest."

The Secretary of Science and Technology also asserted that the reasons for the "possible" (sic) technological lag "...cannot be sought within the scientific and technical system, but rather within the country's general problems." According to the deponent, the cause of the lag is the inadequacy of financial resources, because the government collects only $80 billion (20 percent of the GDP), and the Union Budget contains "totally inflexible" spending. The latter totals 50 percent of the funding for the INSS [National Social Security Institute], as well as constitutional outlays linked with transfers of funds for education to the states and municipalities.

Remaining from all the money collected is "...$15 billion for all the nation's other activities, including medical services, hospitals, etc." Of those funds, only $1.5 billion is appropriated for the science and technology system in all areas, including Embrapa, Fiocruz [Oswaldo Cruz Foundation], and the military ministries. A total of $750 million is assigned to the Secretariat of Science and Technology for its financing organs - Finep and CNPq - and to support the 15 research institutes for which it is responsible.

A decision to increase the funds for science and technology "at any price," according to Goldemberg, would make it necesary to withdraw funds "...from the health area, from the primary education area, or from other areas that are equally needy here in Brazil."

Comparing Brazil's spending on science and technology with that of more developed countries, the Secretary commented, verbatim:

"The one spending little is the nation as a whole, but the government spends the same on that area as is spent by Korea, Japan, and several other countries, such as Canada and Italy: namely, about 0.7 percent of the GDP. Japan spends 0.59 percent of its GDP on research (I mean the Japanese Government). What exists and what isn't mentioned (I want to take this opportunity to explain this point for once and for all) is that, in those countries, the rest of the money is supplied by private enterprise. In Japan, the country spending the most on science and technology in the world, 2.78 percent of the GDP is spent, and the government contributes 0.59 percent. In Brazil, 0.7 percent of the GDP is spent on science and technology, with the government contributing 0.66 percent. In other words, the government contributes approximately 94 percent of what is spent in the area."

The fallacy in the comparison was cited by the CPMI's Reporter, Deputy Irma Passoni, who considered it deceptive to use percentages of the GDP in comparing countries, because what matters are the real amounts spent. The GDP of each of the developed countries mentioned far exceeds that of Brazil. The Reporter Deputy remarked: "Thus, 0.7 percent of Brazil's GDP earmarked for science and technology is very little, in comparison with the same percentage of the Japanese or Italian GDP."

Goldemberg subsequently agreed with the criticism and, exemplifying the differences, observed: "...0.7 percent of the American GDP would be approximately $35 billion."

The data submitted by the Secretary of Science and Technology show internal inconsistency, because 0.7 percent of a $400 billion GDP amounts to $2.8 billion. If the government contributed 0.66 percent of the GDP, its S&T spending should be $2.64 billion, not $1.5 billion, as stated. The latter represents only 0.38 percent of the GDP, and only 53.6 percent of the $2.8 billion spent on S&T in the country (0.7 percent of the GDP). It may be concluded from this that the private sector is contributing 0.32

percent of the fraction of the GDP spent on S&T: that is, 46.4 percent of the total spending. This would represent $1.3 billion, a sum far exceeding the 4 percent indicated by the Secretary of Science and Technology, unless the data furnished to the CPMI are incorrect.

Also admitting and justifying the meagerness of the funds applied by the government to science and technology, the Secretary of Science and Technology declared: "The main thrust of the government's activity is to combat inflation; funds are scarce, and we must live within their bounds."

Besides the shortage of funds, there are difficulties in implementing the budget. Goldemberg comments:

"The appropriations approved by the National Congress for the Secretariat of Science and Technology this year (1991) were 15 percent larger than those last year, as stipulated in the Multiannual Plan. Those funds were made contingent. When I asked how the Executive Branch could make funds approved by the National Government (sic) contingent, the explanation I received was that the Ways and Means Law authorizes, and the Federal Government can disburse only with revenue that it has and with available resources. For this reason, it made the funding contingent" (Jose Goldemberg, 15-8-91).

According to Goldemberg, despite the budgetary problems, some institutions are doing well owing to the creativity of their directors. "I could give several examples. One is the National Institute of Space Research.... Other institutions haven't succeeded. This is associated with problems involving the directors' personalities and the institutions' internal problems."

Deputy Irma Passoni, commenting on the claim made by the Secretary of Science and Technology, gave a reminder that when technicians from the National Institute of Space Research gave depositions in the CPMI, they said quite the opposite: "They complained bitterly about the INPE's destruction, just when the CTA area and the Embraer area were established here." (20-8-91)

Continuing his deposition, the Secretary of Science and Technology asserted that the federal universities have serious structural problems that need to be solved. Otherwise, the Brazilian middle and affluent classes will turn their backs on public higher education, as "has already occurred in primary education." According to the Secretary, the charge of a lack of promotion for universities on the part of the Finep, CNPq, Capes, and other organs, is a "simplistic description of the problem."

Nevertheless, the rector of the Federal University of Rio de Janeiro, Nelson Maculan Filho, claims that funds are lacking for the mere daily operation of the universities. He gave an example, noting:

"The proposed ceiling for the Federal University of Rio de Janeiro in 1992 is less than we received this year, with all the difficulties. So, it's completely impossible. How can a rector run the university today? By not paying all the debts, by not paying the water bill, by negotiating the computer bill, and the IAPAS [Institution for the Administration of Social Assistance and Welfare] bill: in short, negotiating exactly like the indebted country."

In the opinion of Nunes e Nunes, who gave a deposition at the meeting on 2-8-91, it does not suffice to claim "that there is a progressive scrapping of the university infrastructure," that the funds allocated by the MEC to salvage laboratories and information systems in university libraries are infinitely smaller now than a few years ago, or that the salary situation of university professors is "to some extent, deplorable."

According to the deponent, besides the problems cited, there is an important basic issue, namely, "the negation of basic research in the country, in terms of agriculture. We are currently experimenters on the results of work done in other countries." (Laercio Nunes e Nunes, 2-8-91).

Laercio Nunes e Nunes also complained of the "marked interest, from the standpoint of international relations, in constraining the field of science and technology," with the development already achieved in the universities and the system coordinated by Embrapa, so as to "benefit the mechanisms for dependence, which are increased."

According to Bautista Vidal, the funding problem "is not so much what is spent, but how it is spent." He claims that, "Those comparisons with Korea and Italy...are inconsequential; 10 times more could be spent, and the results for the society would be worse than they already are, based on the percentage that was emphasized. This is shown by the fact that, if we spent, and since we spend, the same amount as Italy and Korea, which are countries in world competition, we should be in world competition as well."

Renato Archer agreed that "the funds are meager, but they always have been." The problem is to determine the priorities for using them. In his view, "Anyone talking about modernization can't exclude the absolute priority of science and technology...Any conversation of that kind failing to take science and technology into consideration wouldn't be serious."

According to the Secretary of Science and Technology, the Multiannual Plan increases the funds earmarked for science and technology by 15 percent annually, in real terms; "and that increase, if materialized, would make it possible to double the fraction of the GDP spent on science and technology in five years."

3.9.1.2 - Policy on human resources training

The Capes, subordinate to the Ministry of Education, and the CNPq, an organ of the SCT, support 5,000 grantholders in foreign countries alone, at a cost of $150 million per year. The grants are intended for training and improving university professors and professionals in other fields, either governmental or private.

The grant system is regarded by Secretary Goldemberg as one of the most austere in the country. He claims: "...Those grants are awarded without a political criterion of any kind," and "...No grants are refused for any reason other than merit." Therefore, "The notion that there is an extraordinary shortage of study grants isn't correct."

Regarding the distribution of study grants, the president of the Pernambuco Foundation To Support Science and Technology, Roberto Aguiar, declared at the meeting on 20-8-91 that there was discrimination against the Northeast in the awarding of study grants during 1991. His assertion is diametrically opposed to the statement made by the Secretary of Science and Technology. Aguiar remarks:

"It's also impossible for Capes and CNPq committees to refuse grants for Northeast doctoral candidates abroad, in excellent centers abroad, using the excuse that they haven't yet published, and therefore can't be selected as doctoral candidates. The rule is that a doctorate holder is required to publish, but someone with a master's degree who is finishing the master's course must first publish and later be a candidate for the doctorate! This was common for doctoral candidates in the Northeast this year, and there was a widespread offer of slots for Northeast holders of master's degrees to obtain doctorates in the Southeast."

Continuing his deposition, Roberto Aguiar claimed that there was a shortage of students for doctorates in the Southeast, who are helped by the discriminatory action of the Capes and the CNPq. They force on the candidates from the peripheral regions doctoral courses in the Southeast, "...while the candidates from the central regions are being given grants abroad." The deponent claims that, in the case of Pernambuco, the ties existing with excellent centers abroad would allow for greater speed in the transfer of information and technology than if the candidates from that state were to study in the Southeast.

Secretary Goldemberg also mentioned as a problem related to the human resources training policy the fact that the number of scientists has grown continuously, while the funds for science and technology have remained almost constant during the decade, thus heightening the competition for funds.

3.9.1.3 - Industrial property

Bautista Vidal complained of the "undisputed institutional dismantling of policy planning during the past 12 years" for the structure linked to the Ministry of Industry and Commerce. In the present government, the National Institute of Industrial Property and the Inmetro/Conmetro [National Institute of Metrology, Standardization, and Industrial Quality/National Council on Metrology, Standardization, and Industrial Quality] system are located in the Justice Ministry, although there is a Secretariat of Science and Technology directly linked to the Presidency of the Republic.

The lack of an industrial policy was claimed by Paulo Paixao (Dieese [Interunion Department for Statistics and Socioeconomic Studies]) to be responsible for the abolishment or threatened abolishment of projects with proven success, such as that in the pharmaceuticals development field. In the latter, out of 60 projects 14 are now in industrial production. However, the other 46 failed to go forward, not because the technology was not tested and developed, but because of the lack of an industrial policy to foster the establishment of companies and industries that would produce those pharmaceuticals and put their production on the industrial marketing level.

Bautista Vidal declared that, within a period of under five years, Brazilian firms managed to sell on the market nearly 30 percent of the pharmaceuticals used in the country. "Consequently, within a five to eight-year period, we would be independent in pharmaceutical technology."

But if approval is given for the changes sought by the government in the Industrial Property Code, for the purpose of granting patents in the pharmaceuticals area, "Brazil will cease to have the opportunity to to develop the technology, because the market will be reserved for 15 or 20 years, and there is no way to develop technology except in response to the market."

The Secretary of Science and Technology, Jose Goldemberg, expressing his views on the granting of patents in the pharmaceutical field, remarked: "Patents have never been recognized by the country in the pharmaceutical field, and this has not kept the pharmaceutical industry from thriving." He also noted: "The rapid development that this country has had during the past 25 or 30 years was due to the flow of foreign technology."

In response to Goldemberg, Bautista Vidal claimed that the issue of patents is not very important, except in "specific sectors in which the patent is directly linked to production, as it is in the case of pharmaceuticals. In other words, the patent links, binds, and ensures pharmaceuticals."

According to Bautista Vidal, during the 1920's and 1930's, national private companies controlled 65 percent of the national pharmaceuticals market. With the system established according to the economic model adopted for importing technological packages, the national private enterprise's participation declined to 10 percent. "However, that 10 percent was not eminently significant: it was virtually the packaging of pharmaceuticals. The international groups dominated 100 percent of an absolutely strategic area involving the lives of citizens."

After this had been observed, all areas of the government expended a major effort to make the presence of private firms in the sector possible. That possibility resulted from the "Law on Industrial Property, which impeded patents; that is, it impeded the market reserve in that strategic area. This allowed for the emergence of a dozen technology companies, including Codetec, associated with Unicamp. Scores of technologies were developed, and many products were marketed. It became quite evident that we would soon be dominating the technology in that strategic sector. Then came that imposition, and I was subjected to violent international pressure for a change in the law, to make that potential for national technological development impracticable. And that change, which is being made, is highly significant politically, because it eliminates the only real technological structure for solving the problem" (Bautista Vidal, 15-7-91).

In conclusion, Bautista Vidal declared that the issue of pharmaceuticals "reflects the tone of the general policy" being made in the government's economic area, having

nothing to do with the strategic technological issue. "In the name of openness, market reserves are created, given an incentive, and promoted in areas that are completely unacceptable from the standpoint of development."

3.9.1.4 - The informatics policy

Renato Archer, ex-Minister of Science and Technology, in his introduction to the topic of informatics in Brazil, reported that, when the Brazilian Government created the Special Secretariat of Informatics - SEI, in 1976, to administer the informatics policy adopted then, there were only three Brazilian and nine foreign companies operating in the country. There was only $200 million in our internal market, and foreign firms held 97 percent of that amount. By 1987, the internal market had accrued $7 billion, and Brazil had the sixth largest billing in the world. The United States ranked first, with $13 billion. According to the U.S. Government's prediction, with 30 percent annual growth in the informatics sector, Brazil would reach fourth place on the world market rapidly.

The so-called "Asian tigers" (Korea, Singapore, Taiwan, and Hong Kong), always mentioned as examples of productivity and private investment in science and technology, did not, when combined, attain the billing of the Brazilian firms. Since the passage of the Informatics Law, the latter were obliged to invest 10 percent of their billing in research. Renato Archer comments on this:

"I would like to say (and Professor Jose Goldemberg can obtain this information from the Conin records) that, when the Information Law was regulated and approved, insofar as subsidies were concerned, it was stipulated that the investment required in the research sector was 10 percent. There is a completely specific regulation on this. I would explain to Your Excellency that informatics began that participation by private industry in research investment, not out of patriotism, nor at the government's decision, but for its own survival."

According to the Secretary of Science and Technology, the Informatics Law recently approved in the Chamber of Deputies "has inserted in it a provision specifying that no informatics company shall benefit from a cent in tax incentives unless it invests five percent of its gross billing in science and technology, either in or outside the company." That percentage is smaller than the previous one.

According to Archer, the liquidation of the informatics industry is by now virtually decided. "That industry is not being put in a competitive position, pure and simple." The deponent maintains that the Federal Government's present policy on competitiveness will liquidate the national microcomputer market, because the companies still need to develop their technology further. Contrary to what is occurring elsewhere in the world, Brazil is opening its market. Meanwhile, Europe is becoming unified and closed; Canada is doing the same; and Japan, which has always remained closed, is attempting to form a market in its own geographical area.

No country in the world has coped with problems involving science and technology by opening itself up for imports, nor acquired technological competence with products ready and finished coming from abroad. Archer thinks that the Brazilian market should be preserved as a strategy for scientific and technical development, and as a fundamental tool for economically supporting the entire industrial sector and any type of development that is sought.

Renato Archer also informed the CPMI that there is strong international pressure on the entire activity of Brazilian scientific and technical development. That pressure is not confined to the informatics area, and has become public knowledge through the press. "There are formal commissions regulating the importing of technology into countries other than the seven developed countries, the seven rich countries." The right to import is not given to developing countries.

The Informatics Law passed by Congress in October 1984 underwent international pressure for its amendment as soon as the new government became installed in 1985, even before it could be regulated in the necessary respects and tested.

According to Bautista Vidal, the economic model is allowing the entry of veritable Trojan horses into the country, carrying in their paunches hundreds of thousands of decisions. "A total surrender of national decisions is taking shape, in matters that are totally strategic and vital to our survival. This suicidal model is leading to despair, to inefficiency, and to unfeasibility."

Bautista Vidal claims that the economic model adopted by Brazil 35 years ago was based on bringing in ready-made technological packages from abroad, which are powerful instruments of power, control, and market reserve in a vast multiplicity of sectors. They decide on the use of raw material, on types of production and types of energy, as well as the social strucrture. They decide on the life of the society as a whole... "At the time that the Brazilian society decided (it was a policy decision, Mr. Senator) to adopt a dependent model, it surrendered to foreign decision-makers the fundamental strategic decisions that a nation must never give up....If this model, defended and flaunted with trumpets and celebrations, is not changed, Brazilian society will be unfeasible as a modern competitive society."

Bautista Vidal considers economists incompetent to make decisions on the country's technological area. He remarks:

"In the technological area, they (the economists) must go back to school and acquire much learning, to be able to boast of being decision-makers in an area as all-important and complex in the modern world, the industrialized world, as the technological area" (Bautista Vidal, 15-8-91).

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